ASLO1

FINAL REPORT

Environmental Interaction for EOSAEL
SBIR Phase I
Solicitation #A94-086

COMBIC

Combined Obscuration Model for Battlefield Induced Contaminants

Army Research Laboratory
Battlefield Environment Directorate

SPARTA, Inc.

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13. ABSTRACT *(Maximum 200 words)*

This report documents SPARTA's work on a Phase 1 SBIR effort to plan a PC/Windows-compatible version of EOSAEL software on CD ROM. To accomplish this, SPARTA developed draft versions of the Graphical User Interfaces (GUIs) for all the modules of EOSAEL. Additionally, we created individual icons for each module while maintaining conformity within the set. We implemented the GUI for the COMBIC module and successfully integrated it with the COMBIC FORTRAN code. We incorporated comprehensive on-line help capability into our COMBIC/GUI prototype and recorded the prototype on CD ROM. We demonstrated the cross-platform capability of the COMBIC/GUI prototype by installing and executing it on Macintosh and SUN UNIX platforms, generating identical COMBIC input files to that produced by our PC/Windows compatible version used for the development.

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1.0 INTRODUCTION

This final report documents SPARTA's work on a Small Business Innovative Research (SBIR) Phase I effort to support the US Army Research Laboratory Battlefield Environment Directorate (BED) in the development of a PC-compatible version of EOSAEL. This work was performed under contract DAAL01-95-C-2012 on SBIR topic number A94-086 entitled, "Environmental Interaction for EOSAEL." All work reported herein was performed by personnel in our Huntsville, Alabama office during the contract period 13 March 1995 to 30 September 1995.

This Phase I award is only the beginning -a proof of feasibility of our approach. By the end of Phase II, subject to an award to SPARTA, we will provide BED with the software on CD ROM which will allow a user to conduct analyses/evaluations using any or all of the EOSAEL modules while operating in a Microsoft Windows* environment on a 486 or equivalent PC with a modern Graphical User Interface (GUI) including on-line/context-sensitive help and documentation features. This product will be of considerable utility to environmental effects analysts in both the military and commercial sectors. It will provide these users the many benefits of the extensive model development and validation efforts previously invested in EOSAEL with a GUI that will be comfortable to any user of standard commercial software.

To illustrate the entire process of interface design and implementation, SPARTA developed a prototype for the COMBIC module during Phase I. This COMBIC/GUI prototype includes the COMBIC interface complete with all of the functionality required to provide the user with help, create COMBIC input files, execute the COMBIC module and view the resulting output. The built-in help includes the COMBIC user's guide in a hypertext help facility, as well as, the context sensitive help built into the interface. The product is a multi-language program with the Windows interface routines written in C to provide all the program's calls to the Windows Applied Programming Interface (API) library and the COMBIC Module of the EOSAEL family of models remaining as it exists in FORTRAN to provide the computational services of the module and perform file input and output. The COMBIC/GUI prototype is delivered on a CD ROM. This CD contains all files necessary to execute the COMBIC/GUI prototype interface and necessary EOSAEL routines. The CD also contains install and uninstall routines for setting up the user's hard drive to receive the input and

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output files generated by the user interface and source code. A simple user's guide is provided to help the user install the prototype and gives basic examples of user/window interaction.

SPARTA's approach to GUI developments uses a software development tool (Neuron Data's Open Interface™) that provides the interface capability to other platforms types and allows for easy cross-platform capability. SPARTA demonstrated this cross-platform capability using our Phase I COMBIC/GUI prototype developed in a PC/Windows environment by installing and executing it on a Macintosh and Sun UNIX platforms. We feel that this demonstrated cross-platform capability is a major innovation.

SPARTA has met or exceeded all of the Phase I technical objectives summarized in Section 2 of this final report (and promised in our Phase I proposal). The detailed discussions of our Phase I efforts are organized in Section 3. Section 4 summarizes our Phase I accomplishments. Section 5 contains a brief discussion of why we feel a Phase II effort is technically feasible.

2.0 PHASE I TECHNICAL OBJECTIVES

The technical objectives of SPARTA's SBIR Phase I effort were:

1) Generate a plan for interfacing all EOSAEL modules within the Microsoft Windows environment
2) Plan the Graphical User Interface (GUI) front-ends for each module
3) Create unique identifiable icons for each module
4) Develop a prototype for the Combined Obscuration Model for Battlefield Induced Contaminants (COMBIC) module, and
5) Install and execute the COMBIC prototype Windows application on a CD ROM.

The work performed to meet these objectives is described in Section 3. The first two subsections of Section 3 contain a discussion of the software development tools and the software development process we used in accomplishment of the aforementioned technical objectives. Section 3.3 addresses technical objective 1 and contains our plan for interfacing all of the EOSAEL modules. Section 3.4 provides the draft review and design of the front ends for each of the EOSAEL modules (technical objective 2) and Section 3.5 provides the unique icons we created for each of these modules (technical objective 3). Section 3.6 describes meeting technical objective 4 and contains a discussion of our COMBIC module prototype development. The last technical objective is addressed in Section 3.7, this subsection contains a discussion of the placement of the COMBIC/GUI prototype on a CD ROM and of the execution of the COMBIC module from the CD ROM.

3.0 WORK PERFORMED DURING PHASE I

3.1 Project Software Development Tools

Neuron Data's Open Interface (OI) is a cross-platform Graphical User Interface tool which allows the developer to build a portable GUI across all windowing standards (Microsoft Windows™, OSF/Motif™, Presentation Manager™ and Macintosh®). OI was developed expressly for the purpose of porting GUI's across various platforms (currently numbering in the 40's). The basis for the cross platform flexibility comes from a complete library of functions needed to develop a windows type application (writing to a window, scrollbar movement, button clicks, drawing, printing, etc.). Each platform has this same complete library of functions, each requiring the same parameters and written in C. Hidden to the developer and the user, inside the functions of these libraries are commands specific to the various platforms. On the PC, the internal working on the functions use the Microsoft Windows Software Development Kit (SDK) which is unique to Windows. On another platform, the same C source code can be compiled with that platform's library and the underlying functions use the language of that platform to carry out the task. When moved to another platform, the interface automatically takes on the "look and feel" of the new platform. In other words, the interface will not look like a Microsoft Windows application stuck on the Sun, but will take on the attributes of an open look based application with all of the functionality of the original Microsoft interface. To show the cross platform advantage of using IO, SPARTA has successfully ported the GUI part of the COMBIC prototype to the Macintosh and a Sun Unix system (Open Look and Motif based). An example of the COMIC Meteorological Parameters window for all four platforms can be found in Appendix C. Other tools used include the Microsoft C/C++ and Microsoft FORTRAN compilers.

3.2 Software Development Process

SPARTA used a disciplined software development approach in designing and constructing the COMBIC interface, thus insuring that the product functions correctly and the source code is easily readable and modifiable. Structured programming principles of modularity, top-down flow, visual layout (i.e., wise use of indentation and spacing to improve readability), use of meaningful names for program variables, and commenting were enforced. Object oriented programming philosophy was applied in the design of the software.

We used examples found in the COMBIC user's guide to test the GUI and FORTRAN codes. These test cases were exercised first using the current EOSAEL driver, and the outputs were recorded. The same test cases were then exercised using the Windows interface, and the outputs electronically compared with the first set of outputs to confirm that the interface is working correctly.

3.3 Plan for Interfacing all EOSAEL Modules

Originally, SPARTA proposed a plan to interface all modules together into one cohesive unit which allowed the individual modules to feed other modules. To confirm this plan, SPARTA talked to Dr. Alan Wetmore, the COTR for this Phase I effort and essentially determined from him that very few EOSAEL modules interacted with each other. In addition, each module's documentation was studied during the course of Phase I to determine how it interacted with the other EOSAEL modules. The result of this study is documented in Figure 1. If a number is placed within the matrix it indicates there is a link of some kind between the two modules. Table 1 is a legend for Figure 1. It designates the relationship of the two modules indicated with that number. For instance, the number 2 between COMBIC and BITS says that BITS can optionally use COMBIC output for Concentration Length Data. For the most part, as indicated by Figure 1, the modules are independent of one another. However, there are a few instances of modules calling other modules (e.g., TARGAC and KWIK call XSCALE for atmospheric attenuation inputs, NOVAE optionally calls AGAUS to calculate Mie efficiency factors, and TARGAC optionally calls ILUMA to get ambient illumination data), and several cases in which inputs for one module may be derived from the output of another module (e.g., FASCAT may be called to generate a target contrast for use by TARGAC). The plan then is to create linkages between modules that have such dependencies. Our approach will be to supply a choice button in the window in which any dependent input is specified, which indicates that the input will be derived by running the related module. An example of this can also be found on the figures in Appendix C, where CLIMAT can be used to specify meteorological inputs of COMBIC. If this button is selected, the user will immediately be presented with the main window for the related module and required to set up inputs for that module before continuing with the setup of the original module. In this way the user will not be burdened with a large multi-module interface full of applications that are not needed. We will be able to place emphasis on the individual needs of the module.

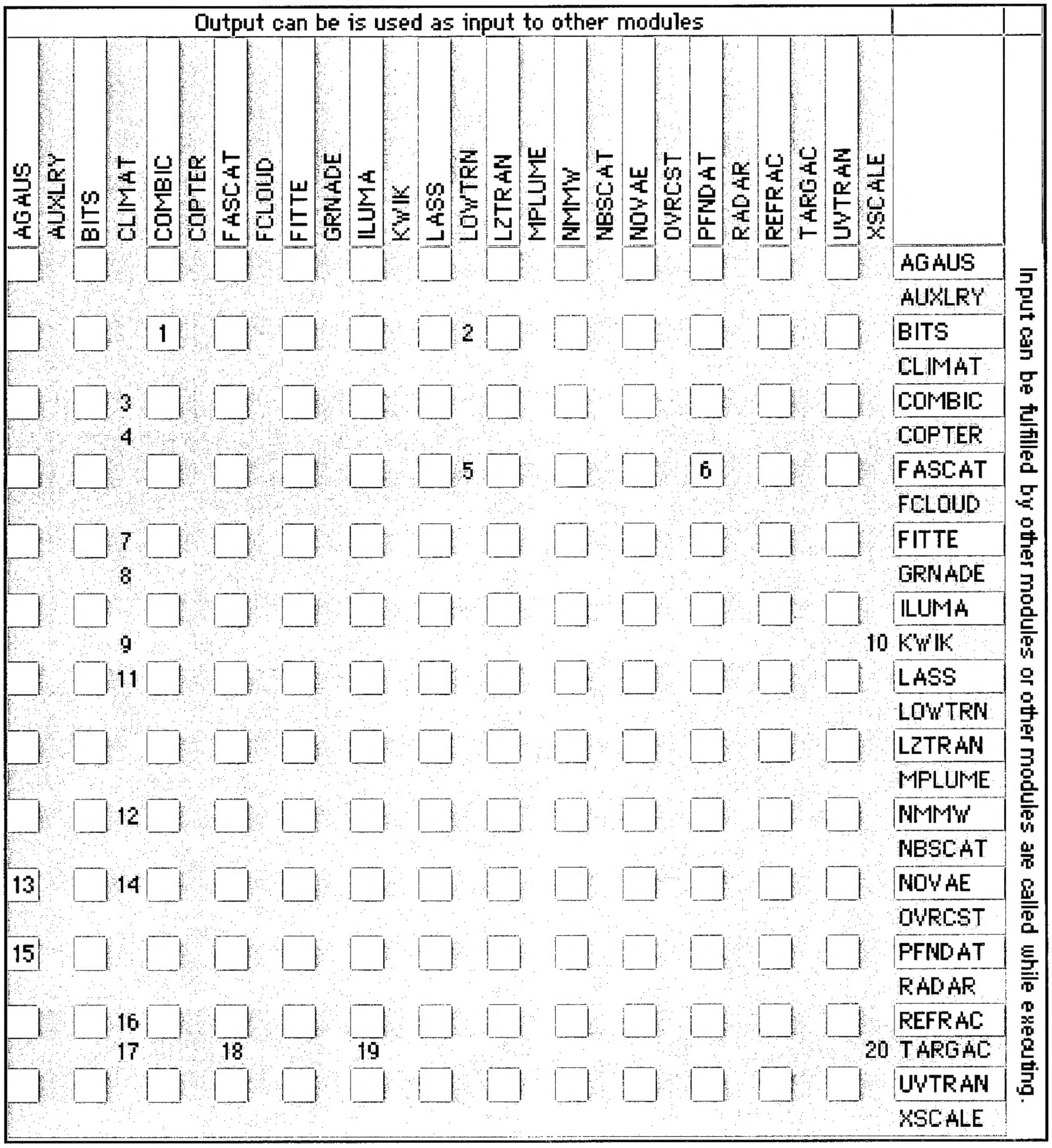


Figure 1. Module Interaction Overview

Figure Number	Module Interaction Description
1	BITS optionally uses COMBIC output file for Concentration Length Data.
2	BITS optionally uses LOWTRN output file for Atmospheric input.
3	COMBIC can optionally get climatology data from CLIMAT.
4	COPTER can optionally get climatology data from CLIMAT.
5	FASCAT can optionally use LOWTRNs Aerosol Models to create FASCATs input for the Optical Profiles.
6	PFNDAT supplies input to FASCAT.
7	FITTE can optionally get climatology data from CLIMAT.
8	GRNADE can optionally get climatology data from CLIMAT.
9	KWIK can optionally get climatology data from CLIMAT.
10	KWIK uses XSCALE
11	LASS can optionally get climatology data from CLIMAT.
12	NMMW can optionally get climatology data from CLIMAT.
13	NOVAE uses input data from AGAUS
14	NOVAE can optionally get climatology data from CLIMAT.
15	PFNDAT is created by AGAUS.
16	REFRAC can optionally get climatology data from CLIMAT.
17	TARGAC can optionally get climatology data from CLIMAT.
18	TARGAC optionally calls FASCAT
19	TARGAC optionally calls ILUMA
20	TARGAC calls XSCALE

Table 1. Module Interaction Table

3.4 Documentation Review and Draft Design of Input Screens for Modules

SPARTA received an electronic copy of the documentation for twenty modules in the EOSAEL family of models. We reviewed the documentation for each of the twenty modules provided by the Government to become familiar with the functionality of each module, to ascertain the required inputs to execute the module, and determine the generated outputs given successful execution. SPARTA used this information to design draft versions of input screens for each of the modules. As shown in Section 3.3, there are interdependencies within the modules of EOSAEL, our draft

designs of the input screens account for the interactions with other modules. These draft designs were generated in parallel with the COMBIC GUI. After a review by the government and if SPARTA is awarded Phase II, SPARTA will eliminate the differences in designs to government approved methods.

In the design of the input screens, SPARTA maintained association to the current terminology, by providing the code variable name as well as the parameter names. For example, an input screen contains not only a descriptive name like time of observation, it also contains the source code variable name WTME. Figure 2 shows an example input screen. Association to the card images was also maintained by preserving the grouping of input parameters. In cases where related parameters were on several cards, this data was grouped, where possible, to appear on one input screen. Typically, each screen corresponds to a card or group of cards under the old system. In the final implementation, defaults and typical values will be shown where applicable. Figure 2 shows an example of a screen with default values and typical values displayed. The units of the input parameters are also provided where applicable.

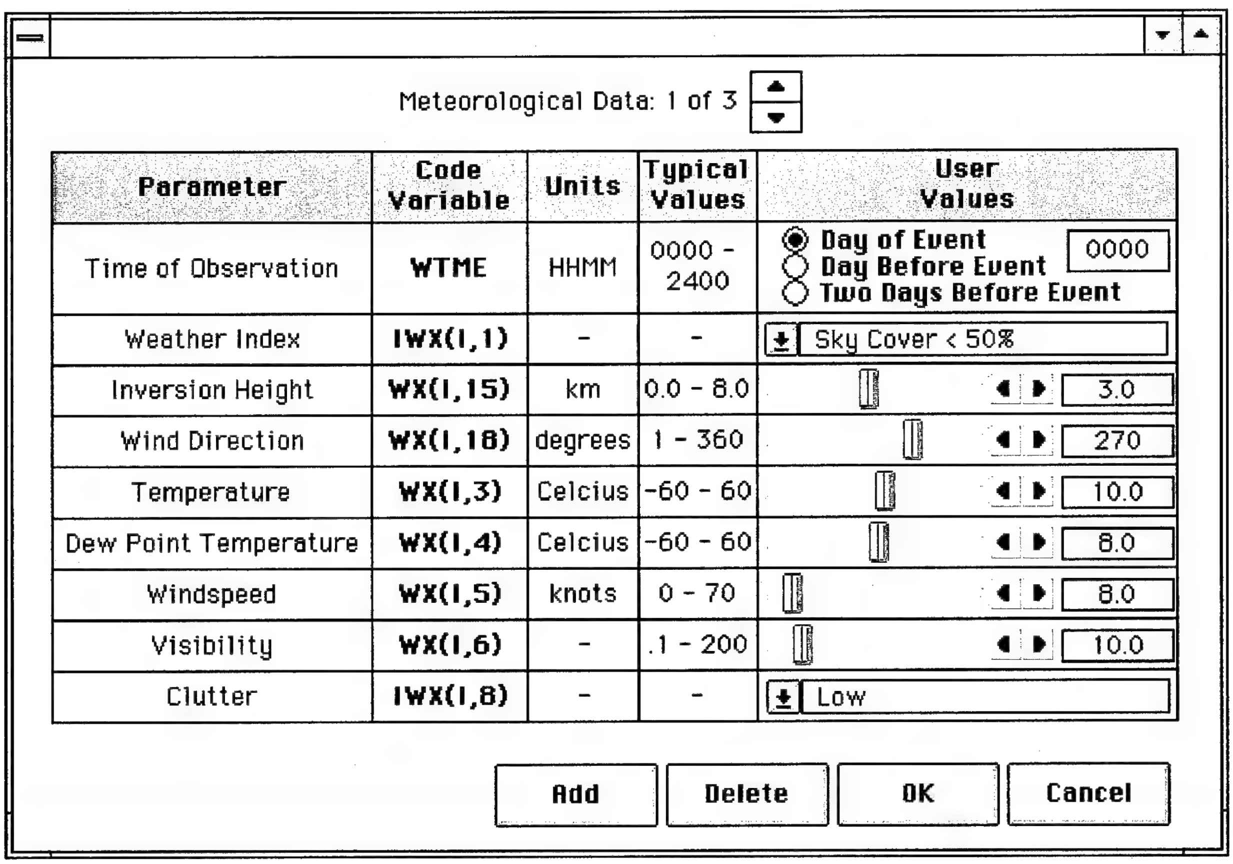


Figure 2. TARGAC Meteorological Screen

SPARTA has designed each module to have multiple layers of help. Each module will provide context sensitive help screen functionality and interactions, and on-line documentation from the menu bar. The various layers of help are described and examples provided in the COMBIC Module Prototype Development section, Section 3.6.5.

In the screen designs and layouts, SPARTA determined the best input method for each parameter. Several methods were available. For parameters with lists, the input method was chosen to be a pull down menu listing all choices. When the list was small, radio buttons were used to display the choices. When ranges were provided, a sliding bar was often used. When the sliding bar was used, an input cell was also provided to give the user the option to enter the value manually. This allows the user to specify values with greater accuracy or outside the typical range. Variables for which the above mentioned input methods were not applicable, are specified with a generic entry cell. An example which shows all input methods is given in Figure 3.

Parameter	Code Variable	Units	User Values	
Specify Reference Height for input Pressure, and Temperature.	PHGHT	km	○ Use ALT(1) ○ User Defined	

Parameter	Code Variable	Units	User Values
Pressure (at ______ km)	PRES	mbar	
Temperature (at ______ km)	TMP	°C	+ 50 … - 50
Model Atmospheric Type	MSCL	-	Tropical
Mean Scale Height	MCLHT	km	8.28491
Initial Layer Thickness	ZDEL	km	

OK | Cancel

Figure 3. LZTRANs Atmospheric Data Screen

In some instances, additional parameters will be needed based on the value of other parameters. In these cases, the dependent parameters will either be active or inactive when applicable. For example, the user may choose to use climatology data generated by CLIMAT. Parameters that are no longer needed will be grayed out and will become inactive.

SPARTA maintained uniformity across each module front end design. Each module will have a main window, like that used for COMBIC (see Section 3.6), and will have the same menu bar. The choices from the pull down menus will be the same as in COMBIC with the exception of the mode, inputs, and view menu choices. The mode and input menu list is determined by the required and optional input for each module. The view list is determined by the associated output. The mode menu choice is often not needed and will be active only when applicable. The Inputs Menu Choices will differ for each module and is shown in the corresponding module section of Appendix A. The view menu choices will be similar to COMBICs with the addition of graphing and plotting choices where applicable. In designing our draft input screens, SPARTA followed the Microsoft guidelines for designing a user interface for window-based applications.

Under the current card image input system, the ability to do multiple (batch) runs exist. This is currently implemented using a "Go Card" method. In the final implementation of our front ends for the various modules, this capability will be available.

In Appendix A, a section is provided for each module to illustrate the draft input screens. Each section contains a brief synopsis of the module. Each draft input screen is shown and a mapping is provided from the old cards. The relevance of the input data is also given when known. Discussions of additional functionality are provided when needed.

Based on our review of the other EOSAEL modules, SPARTA feels that the COMBIC prototype development dealt with most user interface issues to be encountered in the other EOSAEL modules. We will be able to maximize the reuse of previously developed code.

3.5 Unique Icons Created for Each Module

SPARTA has designed and created an icon for each of the current EOSAEL modules. After reviewing the documentation for each module and

becoming familiar with the modules functionality, a picture sketch was created and given to our graphics department to be drawn and colorized. Each icon was designed to look similar to each other in order to create a felling of conformity. Special attention to background color, color scheme, and figure types was used to enhance this conformity throughout the icon set. Once these pictures were completed, further manipulation was done in order to create the required 32 by 32 bit icon. The final version of these icons is shown in Figure 4.

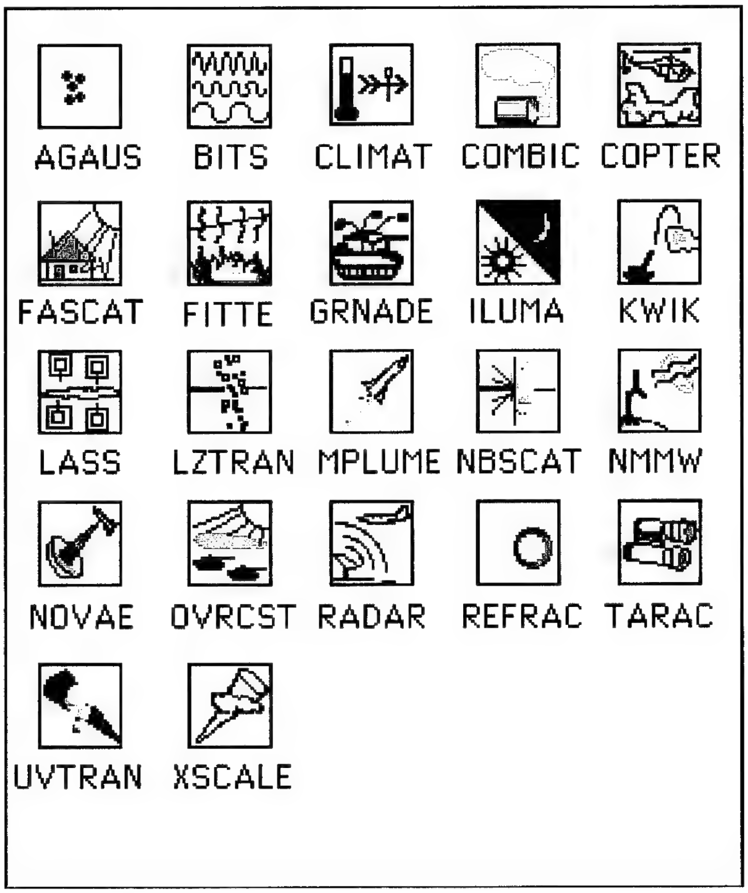


Figure 4. Icon Designs For Each EOSAEL Module

3.6 COMBIC Module Prototype Development

To illustrate the complete process of developing a GUI and linking it to the FORTRAN EOSAEL modules, SPARTA produced a complete prototype of the COMBIC module. We designed the interface, programmed the functionality of the windows resources, provided the user with multiple levels of help, programmed the application to generate the

COMBIC input files, set up calls to the FORTRAN routines, generated a view capability for looking at the resulting COMBIC output and verified the results with document example cases.

3.6.1 COMBIC Interface Design

3.6.1.1 COMBIC Main Window

In the designed interface, SPARTA has made a main COMBIC window focal point for the module's interface and all activities associated with the module will be activated from this main window. This main window comes up when the user clicks the COMBIC icon from the windows environment. The window acts as a backdrop to all other windows associated with COMBIC. All user activities are prompted with commands found in the main window's menu bar. These activities are grouped under these six headings: **File**, **Mode,** **Input**, **Run**, **View** and **Help**. Figure 5 shows the COMBIC main window.

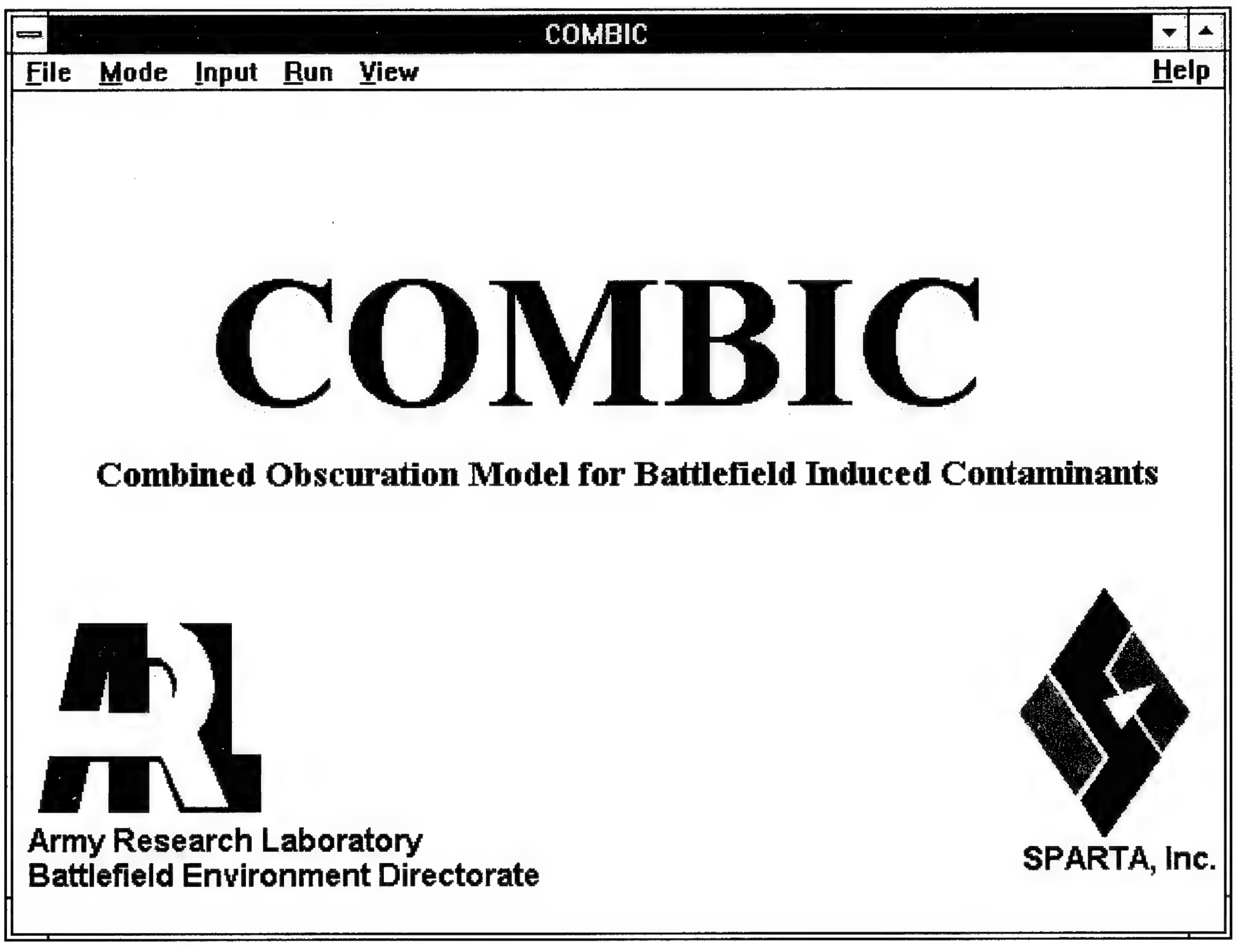


Figure 5. COMBIC Module Main Window

File is set up like most Windows application File menus to contain commands like **New**, **Open**, **Close**, **Save**, **Save As ...**, and **Exit**. All of these commands are familiar and will deal with the COMBIC associated data files. Because this is a GUI and we anticipate the user will run COMBIC from the GUI, the interface keeps up with only two files: name.ph1 and name.ph2. They are the COMBIC interface data files created by the interface, for the interface, anytime a Save or a Save As... is performed. They contain all the information necessary to fill the GUI with the information specified by the user for Phase I and Phase II, respectively. From these two files, once opened, the GUI can generate all other files needed by COMBIC and the user. These files facilitate the retrieval of inputs defined (and saved) in a previous session so that the user need not start over with COMBIC defaults in each session. Other files that can be generated and saved by the GUI are discussed in section 3.6.4.

The **Mode** menu bar pull down menu has three options: **Phase I**, **Phase II** and **Both**. Depending on which mode has been selected, only certain options of the **Input** menu are available to the user. Specifically, if Phase I is the mode selected, only **Control, Environment** and **Munitions** are available options under Input. For Phase II, **Control** and **Target-Observer Laydown** are available. The reason for this is to eliminate any unnecessary effort or confusion for the user. If the user selects **Both** from the **Mode** menu all input options are accessible. The GUI will also use this mode information to determine what information goes into the input file and the COMBIC Input Summary (section 3.6.4).

User inputs are grouped logically within the user interface as in the current EOSAEL card input format. The selections on the **Input** pull down menu for Phase I and Phase II are as follows.

- Phase I, **Environment** and **Munitions**. Within the **Environment** input selection the program takes care of required inputs that currently are handled with the MET1, MET2, PSQ1, PSQ2 and TERA cards. The **Munitions** Input selection takes care of all data required on the MUNT, BURN, DUST, SMLD, VEHC, BARG, EXTC, CLOU, SUBA, SUBB and SUBC cards.
- Phase II, has one selection, **Target-Observer Laydown** which takes the user to a window that handles all Phase II inputs: ORIG, TIME, LIST, OLOC, TLOC, SLOC, VEH1, AND VEH2. Both Phase I and Phase II require wavelength information and this is handled with the **Control** option under **Input**.

From the **Run** option, the user may do two things, **Generate Input File** and **Execute COMBIC**. The first option does as it says and generates the input file based on the current user specifications. This is then available for viewing. The second, also generates the input file, but then begins the actual COMBIC execution.

Under the View option of the menu bar, the user will be able to view the output from both the interface and the EOSAEL module itself. In the case of COMBIC, output from the interface will be the interface summary file and the COMBIC input file. In addition to these, the COMBIC produced text output file may also be viewed here. A contour plot option is available under this menu. These options are more thoroughly discussed in Section 3.6.4.

From the Help pull down menu, the user can access full documentation for the COMBIC module in an On-Line-Help format. This can be accessed by choosing Contents or Table of Contents. See Section 3.6.5 for a complete discussion on the On-Line Help. This menu also provides information on **Technical Support** and **About COMBIC** window.

3.6.1.2 Data Input Windows

The primary purpose of a windows environment interface is to make the data input process easier for the user. These windows were designed to maximize the information available to the user and minimize the effort required to specify a value. Figure 6 shows the Munition Definition Window. The tabular format, shown mostly in gray, is one way or organizing and presenting the maximum amount of information. Each parameter fills a row in the table and each entry type forms a column. Here we give a short description name for the parameter, the source code variable name to maintain a link to the source, the specified units and typical values where applicable. Munition Type (SMENU) and Obscurant Type (STYP) are Choice Lists where all available choices are given. The user only needs to read the list and make a choice. As the user makes a selection from the SMENU list the defaults associated with the other parameters change to reflect the defaults associated with the new choice. Check buttons are provided on the lower half of the window to allow the user access to the more detailed and optional munitions definitions parameters. While these inputs are still part of the munitions definition input area, the details are kept out of the way until they are specifically asked for. When a check box is clicked, another window will come up for

input definition specific to the check button selection. The buttons show a checkmark to indicate these details are being specified for this source. To allow for the multiple munitions defined in a Phase I COMBIC run, we have built in a looping feature which lets him essentially step up or down through his list of munitions. As the user adds a new munition definition (Add Button), the list expands. The user can also delete a munition definition by selecting the Delete Button. Other standard buttons that appear on every window include OK and Cancel. OK specifies, "I am finished with this section, save the information and Exit". Cancel on the other hand means, "Do not make any changes and Exit".

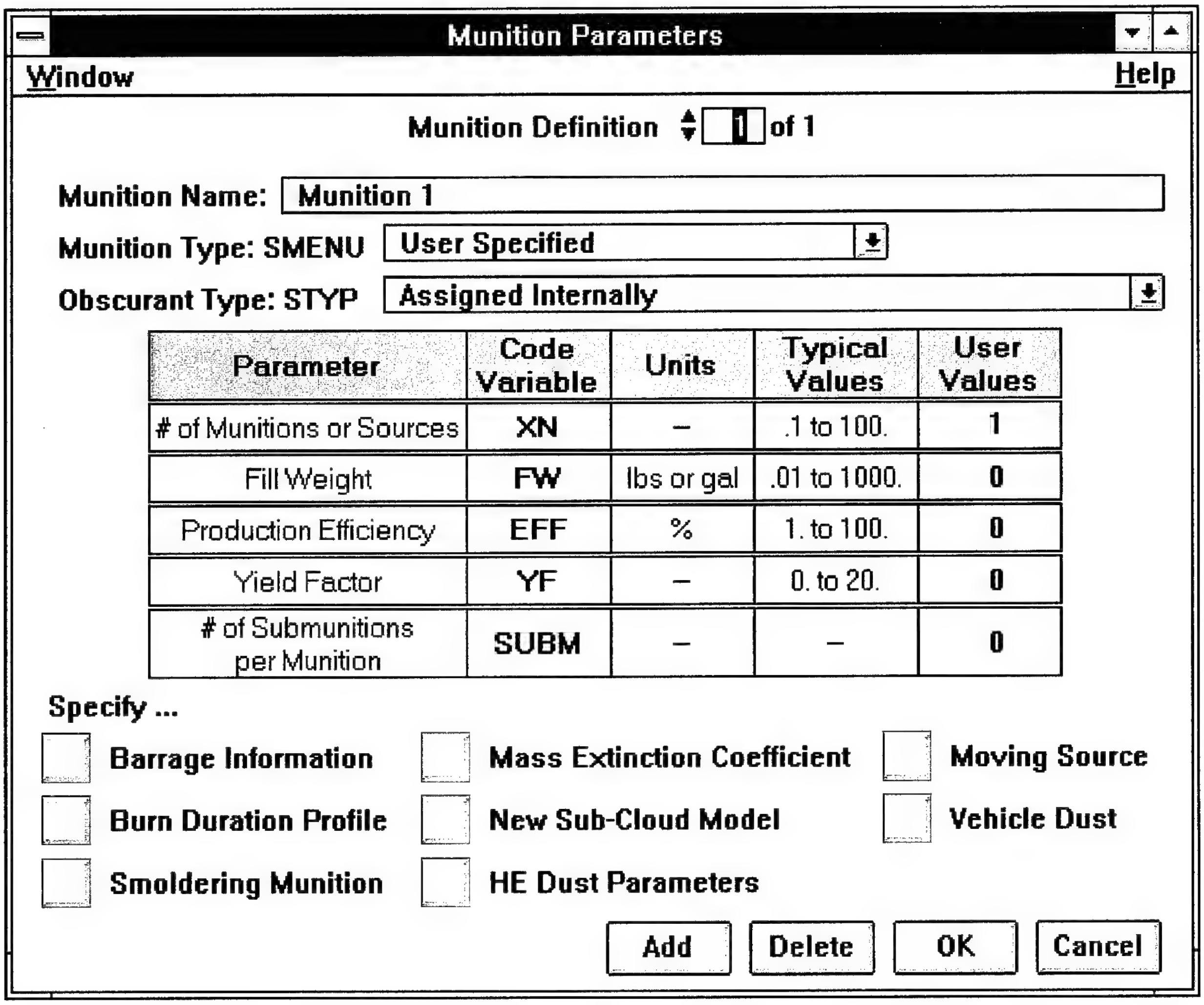


Figure 6. Munition Definition Window

In addition to the On-Line-Help from the menu bar **Help**, there is an **About this Window** option. This option gives information specific to helping the user interact with the current window. Context-sensitive help is available on every input window. To know where the context sensitive help is located, the user only has to watch the cursor. The cursor will change from an arrow to a pointing hand when the help is available. Then the user only has to click on the parameter description or variable name and a help window will pop up with information about the parameter. In this case, clicking on "Yield Factor" pops up the window in Figure 7.

◆ **For smokes (dimensionless), the ratio of the total airborne mass of obscurant and absorbed water to the total mass of oscurant alone.**

◆ **For HE explosions, the crater volume scaling factor:**

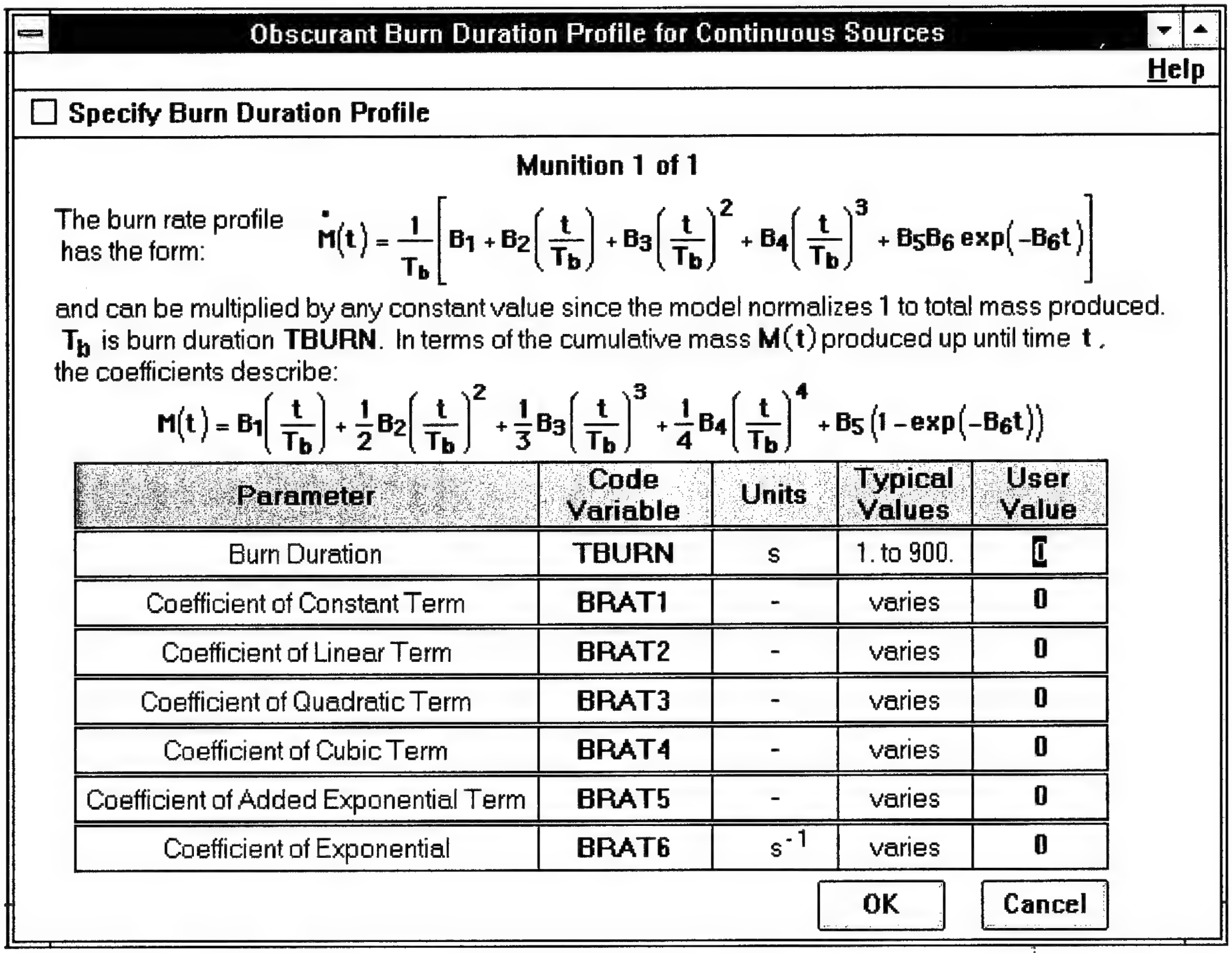
$$S_{ac}(m^3/TNT^{1.111}).$$

If 0., internal models are used.

OK

Figure 7. Context-Sensitive Help for Yield Factor

Windows that spawn from the main windows like Environment and Munitions are very similar in format to the window just discussed. An example is shown in Figure 8 for the Burn Duration Profile which is initialized from the Munition Definition window. A difference is the check box at the top of the screen, in this case labeled, "Specify Burn Duration Profile". This check box is a means for the user to say, "Yes, I want these parameters specified". It clues the code, that these parameters although optional are being specified. A checkmark will appear on the previous window indicating that the parameters are being used as a visual reminder to the user. The code is sensitive to the fact that changes are being made to the parameters and if the user tries to leave the window without checking this box the code will confirm, with the user, that this is what he actually intends to do.



Obscurant Burn Duration Profile for Continuous Sources

Help

☐ Specify Burn Duration Profile

Munition 1 of 1

The burn rate profile has the form: $\dot{M}(t) = \frac{1}{T_b}\left[B_1 + B_2\left(\frac{t}{T_b}\right) + B_3\left(\frac{t}{T_b}\right)^2 + B_4\left(\frac{t}{T_b}\right)^3 + B_5 B_6 \exp(-B_6 t)\right]$

and can be multiplied by any constant value since the model normalizes 1 to total mass produced. T_b is burn duration **TBURN**. In terms of the cumulative mass $M(t)$ produced up until time t, the coefficients describe:

$$M(t) = B_1\left(\frac{t}{T_b}\right) + \frac{1}{2}B_2\left(\frac{t}{T_b}\right)^2 + \frac{1}{3}B_3\left(\frac{t}{T_b}\right)^3 + \frac{1}{4}B_4\left(\frac{t}{T_b}\right)^4 + B_5\left(1 - \exp(-B_6 t)\right)$$

Parameter	Code Variable	Units	Typical Values	User Value
Burn Duration	TBURN	s	1. to 900.	0
Coefficient of Constant Term	BRAT1	-	varies	0
Coefficient of Linear Term	BRAT2	-	varies	0
Coefficient of Quadratic Term	BRAT3	-	varies	0
Coefficient of Cubic Term	BRAT4	-	varies	0
Coefficient of Added Exponential Term	BRAT5	-	varies	0
Coefficient of Exponential	BRAT6	s^{-1}	varies	0

OK Cancel

Figure 8. Burn Duration Profile Window

Within the Phase I effort, SPARTA strived to simplify the input effort and user understanding as much as possible. This is shown clearly in the Phase II portion of the COMBIC module. The majority of inputs are related to scenario, the lay down of observer-target line-of-sight pairs and source placement. This could have been handled with the input formats discussed thus far. Instead, we programmed a graphical tool that allows the user to "draw" out his scenario by placing the various elements on a map. Figure 9 shows the Target-Observer Laydown window.

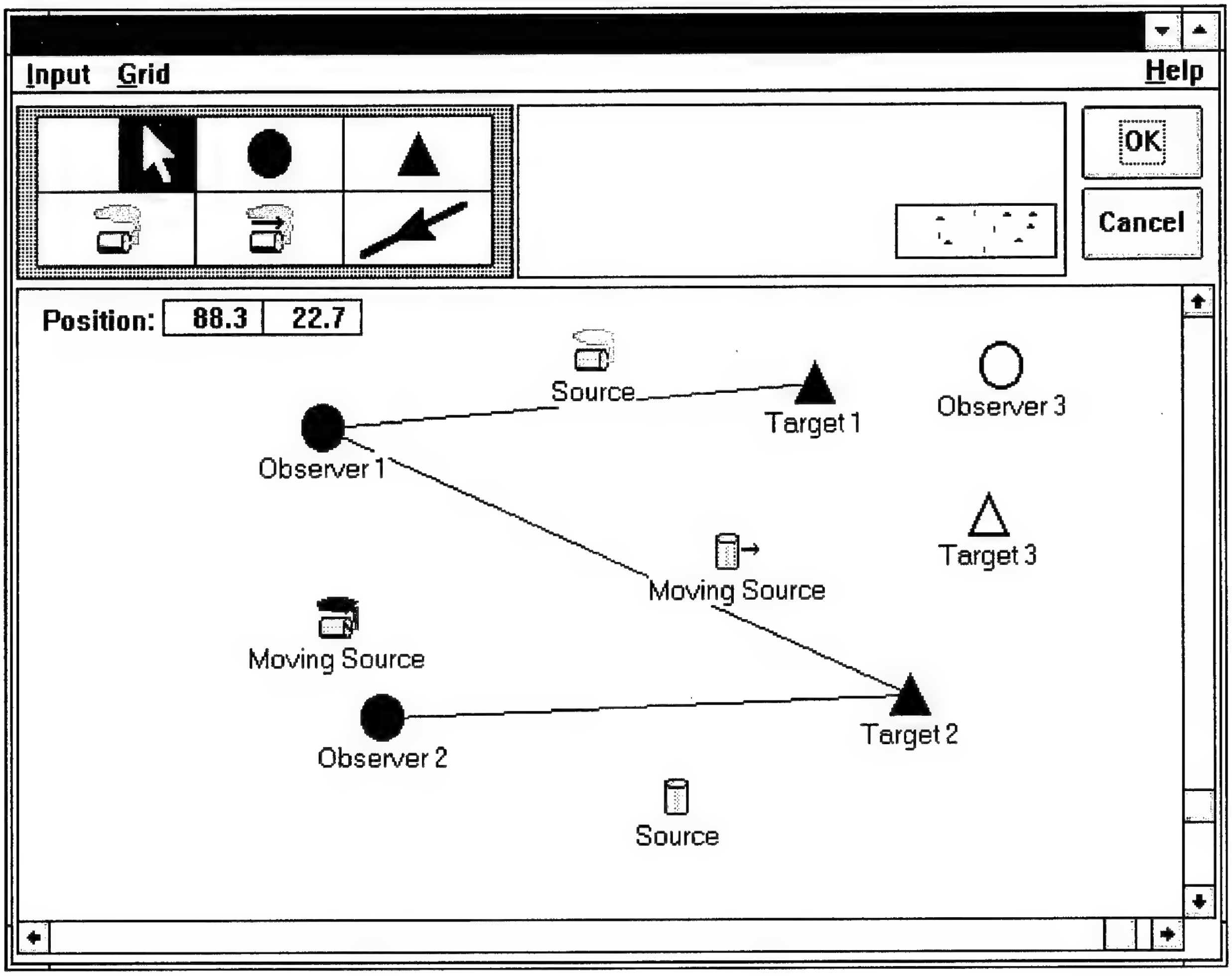


Figure 9. Target-Observer Laydown Window

This window is a graphical environment and interaction with it should be familiar to most Windows users. Parts of the window include the menu bar. Just below the menu bar at the left of the window is a Tool Box. To right of this is an Overview, which gives a miniature view of the Work Area, the bottom portion of the window. The battlefield Observers, Targets and Sources are positioned in the Work Area. The user may navigate the Work Area by using the scroll bars or by moving the wire box of the Overview. The required spread and size of the battlefield area will dictate how much of the Work Area will be needed.

The Tool Box provides the user with the means to specify the various pieces of Phase II scenario. The selection tool (arrow shape) is used for selection of various elements of the scenario and navigation around the screen. Observers are represented by the Blue circle, Targets are the Red triangle, Stationary Sources are shown as a smoking canister and Moving

sources by the smoking canister with an arrow. The Line-of-Sight (LOS) tool (line with arrow) is used to connect observers to targets and set up the LOS.

To add elements to the battlefield, choose the correct tool from the Tool Box and click the left mouse button in the Work Area where the element is to be placed. The top left hand corner of the Work Area contains a position indicator. If the user keeps an eye on the position (x,y), it indicates exactly where the element will be placed on the battlefield. Once placed on the battlefield, the coordinates can be re-specified and other parameters entered by double clicking the left mouse button on the element. Each of the four types of elements has a different window that comes up with the parameters required for that element. Once the user has specified these parameters and they have been "OK'd" by the code, the icon representing the element will change to its final form. (Observers from an open circle to a filled circle, Targets from an open triangle to a filled triangle, and Sources from an upright canister to a smoking canister).

To specify a LOS between an Observer and Target, choose the LOS tool from the Tool Box.

1) Click left mouse button on the Observer
2) Click left mouse button on a Target. Observers can have multiple Targets and Targets can have multiple Observers.

So that the map represents a scenario reasonable battlefield, the use may change the grid size represented. The basis of the grid is a 200 x 100 coordinate area. 0,0 is the center. The overall size can be changed by selecting **Grid** from the menu bar. This brings up a window where the use can specify a multiplier. For multiplier of **5** the resultant battlefield 1000, 500. Again 0,0 is at center.

Examples of all COMBIC windows can be found in Appendix B.

3.6.2 COMBIC Window Functionality

Once the interface had been designed, SPARTA used Neuron Data's Open Interface tool to build the Windows resources. On completion, OI generates a source template written in C and a resource file containing a complete description of the windows and their resources which defines the windows during application runtime. The template is the ground zero starting point for developing the user interface source code. Based on the windows defined for COMBIC, SPARTA started with 9970 lines of C code

generated in the template files. Adding functionality to the windows required another 13,450 lines of code for a total of 23,420 line of C code developed. The functionality includes moving through the input windows as directed, programming menu bars, creating data structures for saving the users inputs, checking the validity of the user inputs, implementing context-sensitive help, generating COMBIC input files and viewing capabilities.

3.6.3 EOSAEL/COMBIC Input Files

From the COMBIC user's guide, SPARTA determined the exact layout and card image ordering required for proper input. We take the stored user inputs, do any appropriate verification and use a standard IO Stream output method for creating the input files. These input files contain EOEXEC specific control card images like (PHAS, GO, DONE, FILE, etc.), as well as, COMBIC card images. We make use of the EOSAEL defined NAME card to document the input files. Once the input file has been created, the program calls the COMBIC FORTRAN DLL to execute the COMBIC code. An example GUI generated COMBIC input file is shown in Figure 10.

```
WAVL              1.060     0.0000     0.0000
COMBIC
PHAS                1.0        0.0        0.0        0.0        0.0        0.0        0.0
FILE                9.0COMHIS
NAME
MET1             RELHUM         UW       PCAT       AIRT      PRESR    WINDIR      COLDR
MET1              90.00      5.000      3.000      27.50      962.5     202.4     0.0000
NAME
     Munition 1
NAME
MUNT                 XN         FW     SMENU       STYP        EFF        YF       SUBM
MUNT              1.000     0.0000     1.000     0.0000     0.0000    0.0000     0.0000
NAME
155-mm HC M1 canister
NAME
Hexachloroethane (HC) smoke
GO
NAME
     Munition 2
NAME
MUNT                 XN         FW     SMENU       STYP        EFF        YF       SUBM
MUNT              1.000     0.0000    0.0000      9.000     0.0000    0.0000     0.0000
NAME
Fill weight has been specified outside of the typical value range.
NAME
User Specified
NAME
Dust, vehicular
NAME
VEHC             VSPEED     VWIDTH     VWEIGH     VEHTYP     VEHDIR
VEHC              4.000      3.000      60.00      1.000      90.00
GO
DONE                0.0        0.0        0.0        0.0        0.0        0.0        0.0
END
STOP
```

Figure 10. COMBIC GUI Generated Input File

3.6.4 Viewing COMBIC Output

SPARTA has developed a capability to view all text input and output files associated with the COMBIC module. These options are available from the **View** Menu of the Main COMBIC window (Figure 11). At any point in the input definition process, the user can view the **COMBIC Input Summary**. This is a text description of the inputs that have been supplied so far. If the user chooses to save this file, the COMBIC run can be accurately regenerated from this description. An example is given in Figure 12.

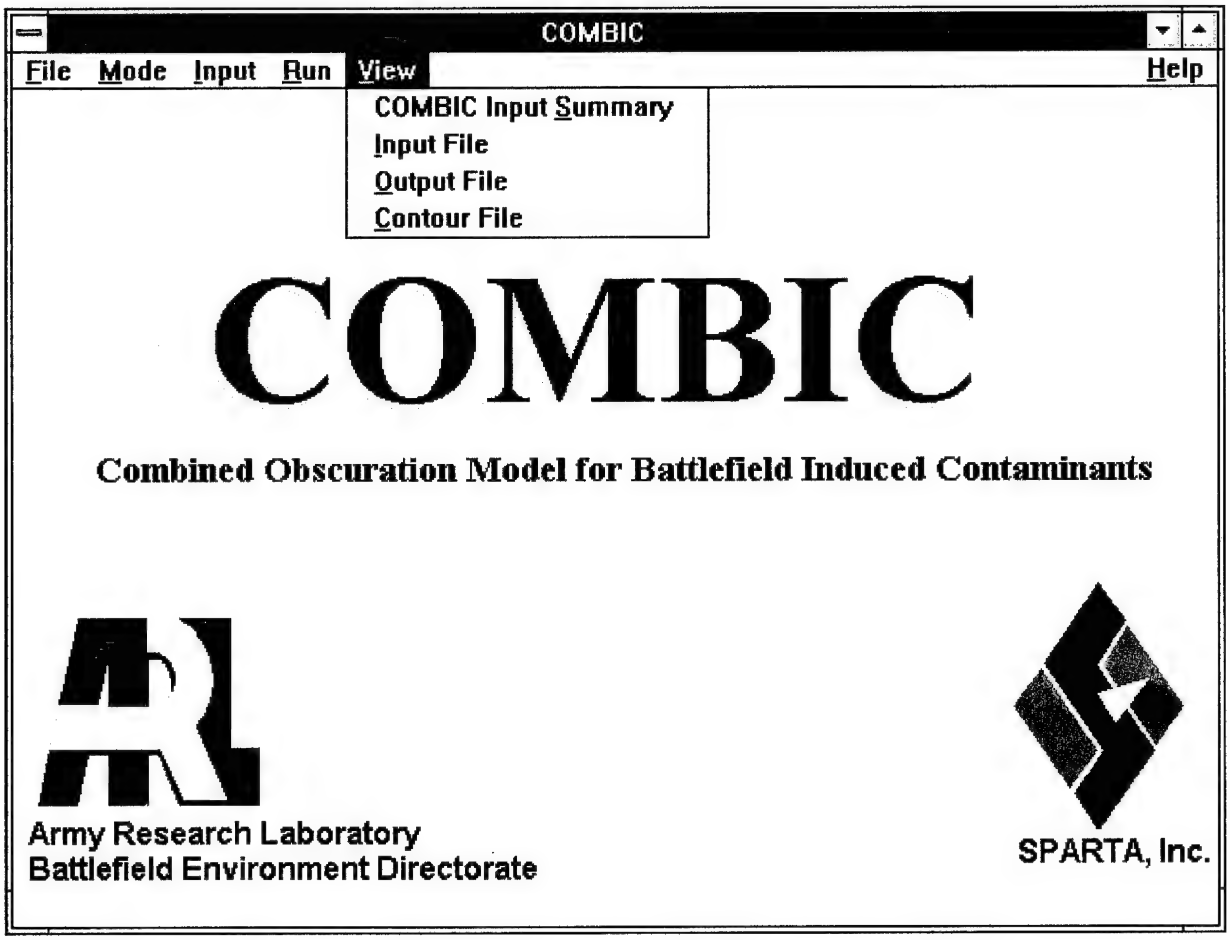


Figure 11. Context-Sensitive Help for Yield Factor

Once the user has specified all required information, and generated the input file from the **Run** menu, the **Input File** option under **View** will be available. This shows the exact COMBIC input file as COMBIC will use it (see Figure 11 above). Note, the use of the NAME card to label all inputs for easy identification by the user. And finally, after COMBIC has been executed, the **Output File** option is available and the user can view the

standard output file generated by COMBIC. Currently, in this prototype development the contour plot specification inputs have not been fully implemented. SPARTA has made available a typical Contour plot output file for viewing. The user can view this at any time simply by selecting **Contour File** from the **View** Menu. A partial example shown in the actual viewing window is shown in Figure 13. With the exception of the summary, all of these files can be saved under a user specified name. This way it can be taken outside of the GUI and manipulated as the user wishes, including input to a non-GUI form of COMBIC. All of these files can be printed to an attached printer.

```
File
                    *************************
                    * COMBIC Input Summary *
                    *************************

Control Specifications:
   Wavelength (WAVE1):       1.060
              (WAVE2):      0.0000
              (MULDV):      0.0000

*************************
*  Phase I Parameters   *
*************************

Meteorological Parameters

   Refercence Height (ZREF):       10.00
   Relative Humidity (RELHUM):       90.00
   Windspeed (at    10 m) (UW):       5.000
   Air Temperature (at    10 m) (AIRT):       27.50
   Air Pressure (at    10 m) (PRESR):       962.5
   Wind Direction (WINDIR):       202.4
   Not a Cold Region (COLDR).
   Pasquill Stability Category (PCAT):       3.000

Munition
   Munition Name: Munition 1
   Munition Type (SMENU):       1.000
   ** 155-mm HC M1 canister
   Obscurant Type: (STYP):       3.000
   ** Hexachloroethane (HC) smoke
   # of Munitions or Sources (XN):       1.000
   Fill Weight (FW):       5.400
   Production Efficiency (EFF):       70.00
   Yield Factor (YF):       5.725
   # of Submunitions per Munition (SUBM):       1.000
   Munition Name: Munition 2
   Munition Type (SMENU):      0.0000
   ** User Specified
   Obscurant Type: (STYP):       9.000
   ** Dust, vehicular
   # of Munitions or Sources (XN):       1.000
   Fill Weight (FW):      0.0000
   ** Fill weight has been specified outside of the typical value range.
   Production Efficiency (EFF):      0.0000
   Yield Factor (YF):      0.0000
   # of Submunitions per Munition (SUBM):      0.0000
     *Vehicle Dust
     Vehicle Speed (VSPEED):       4.000
     Vehicle Width (VWIDTH):       3.000
     Vehicle Weight (VWEIGH):       60.00
     Vehicle Type (VEHTYP): Tracked
     Vehicle Direction (VEHDIR):       90.00
```

Figure 12. COMBIC Input Summary File

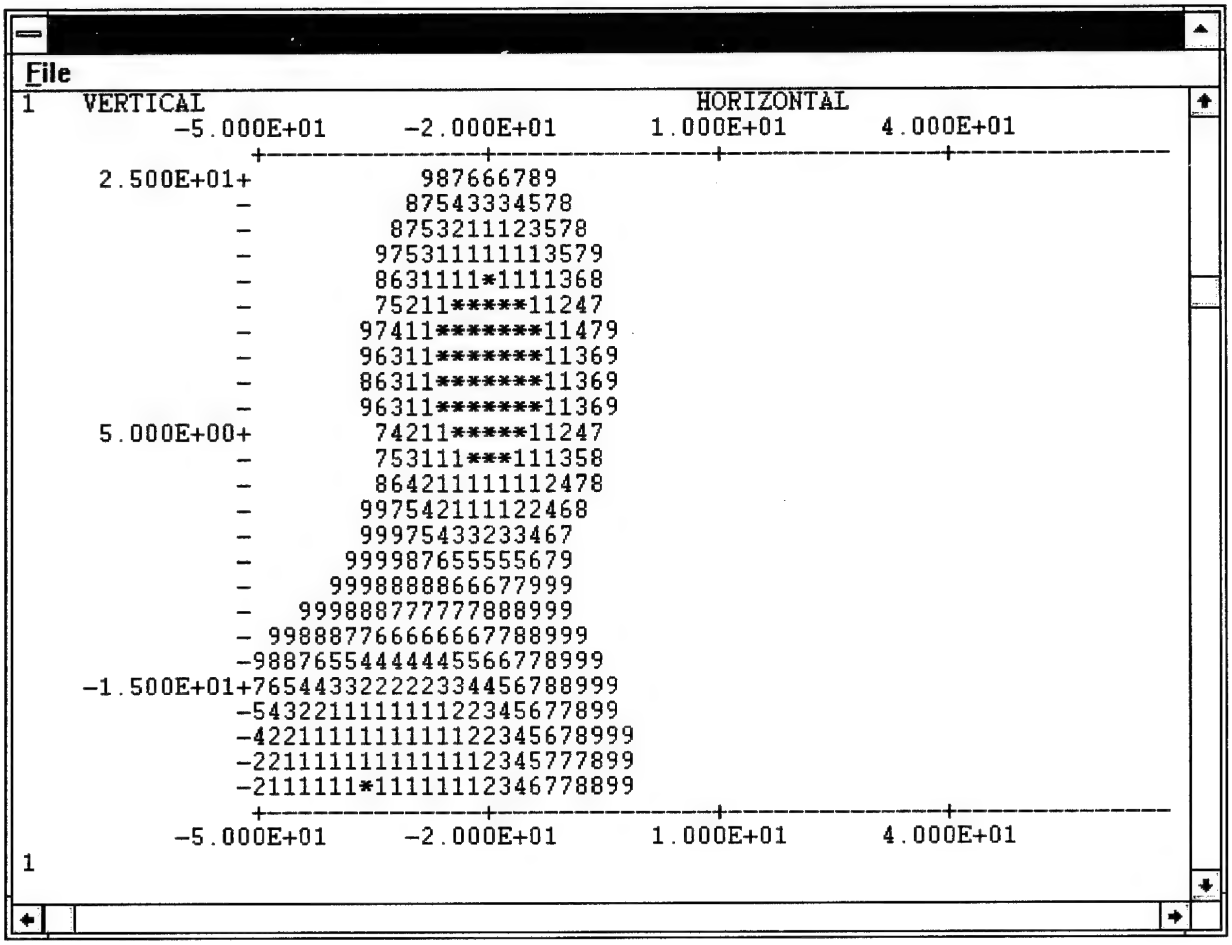


Figure 13. Contour File View Capability

3.6.5 On-Line Help Capability

An on-line help capability was developed as an integral part of the COMBIC Graphical User Interface (GUI) to assist the user in input specification. Current documentation of the COMBIC module was provided and that documentation formed the basis for the content of the on-line help. Documentation text was re-organized appropriately for on-line-help display and documentation graphics were re-drawn to present high quality color graphics in the on-line help.

Figure 14 shows an example of the on-line-help screen. The buttons along the top of this window provide maneuverability through the help document or invoke other screens that contain additional information. Colored text in the help window provides additional functionality and

maneuverability. A brief description is provided for each functionality with a more detailed description provided below.

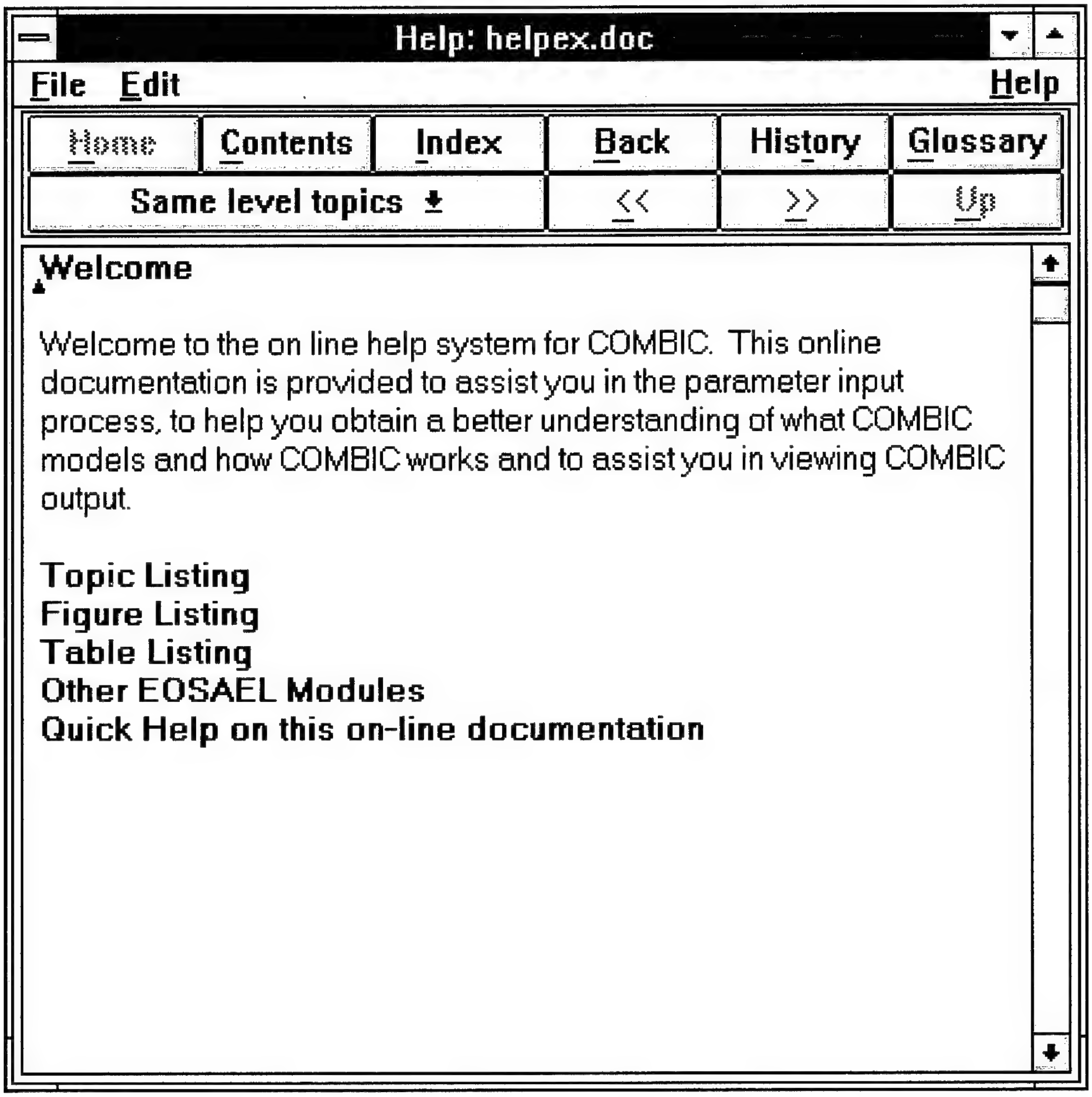


Figure 14. On-Line-Help Main Screen

- The Home button will return the user to the welcome screen shown in Figure 14.
- The Contents button will activate a window with a listing of all topics contained in this help.
- The Index button activates a window that displays a listing of keywords and the corresponding topics where these keywords are discussed.

- The Back button returns the user to the previous topic viewed.
- The History button displays the list of topics visited during the current section.
- The Glossary Button displays glossary terms and there definitions.
- The Same Level Topics "pull down" list allows the user to specify the functionality of the arrow buttons to the right. These arrow buttons move the user backwards or forwards through the topics.
- The Up button displays the parent topic of the current topic.

In order to take advantage of all these features, manipulation of the text was performed to add the needed annotations and markers for the help engine. Manipulation of the graphics was also done in order to display a high quality version of the tables, figures, and equations.

3.6.5.1 Text File Manipulation

The Government provided electronic documentation for the COMIC module via the DoD TEC NET system. Several file formats were provided based on the information content. A postscript version of the COMBIC documentation was provided along with individual gif files containing the figures. The postscript file contained the entire document as seen in hard copy. An ASCII text version of the document was also provided by ARL-BED for this task.

Topics were identified by reviewing the provided documentation and analyzing the section and paragraph structure. We assumed the section structure would translate to the Topic/Subtopic structure. Inappropriate sections were omitted and some complex sections were broken down into several topics. Keywords were identified by reading the text and identifying concepts that were emphasized. Glossary terms consist of terms and acronyms that were defined in the documentation. During the discussion of a topic in the documentation, we noted when foreign ideas, concepts, equations, tables, and figures from other topics were encounter We tagged these as candidates for the jump capability that provides hypertext movement and allows direct jumps to the defining text in other sections. For instance, when a topic refers to an equation in another topic, a jump to that equation was provided.

Annotated text, which means text with embedded commands, was needed to add the functionality described above and provide the topic, keywords, glossary terms, jumps, and other features of the Help Window.

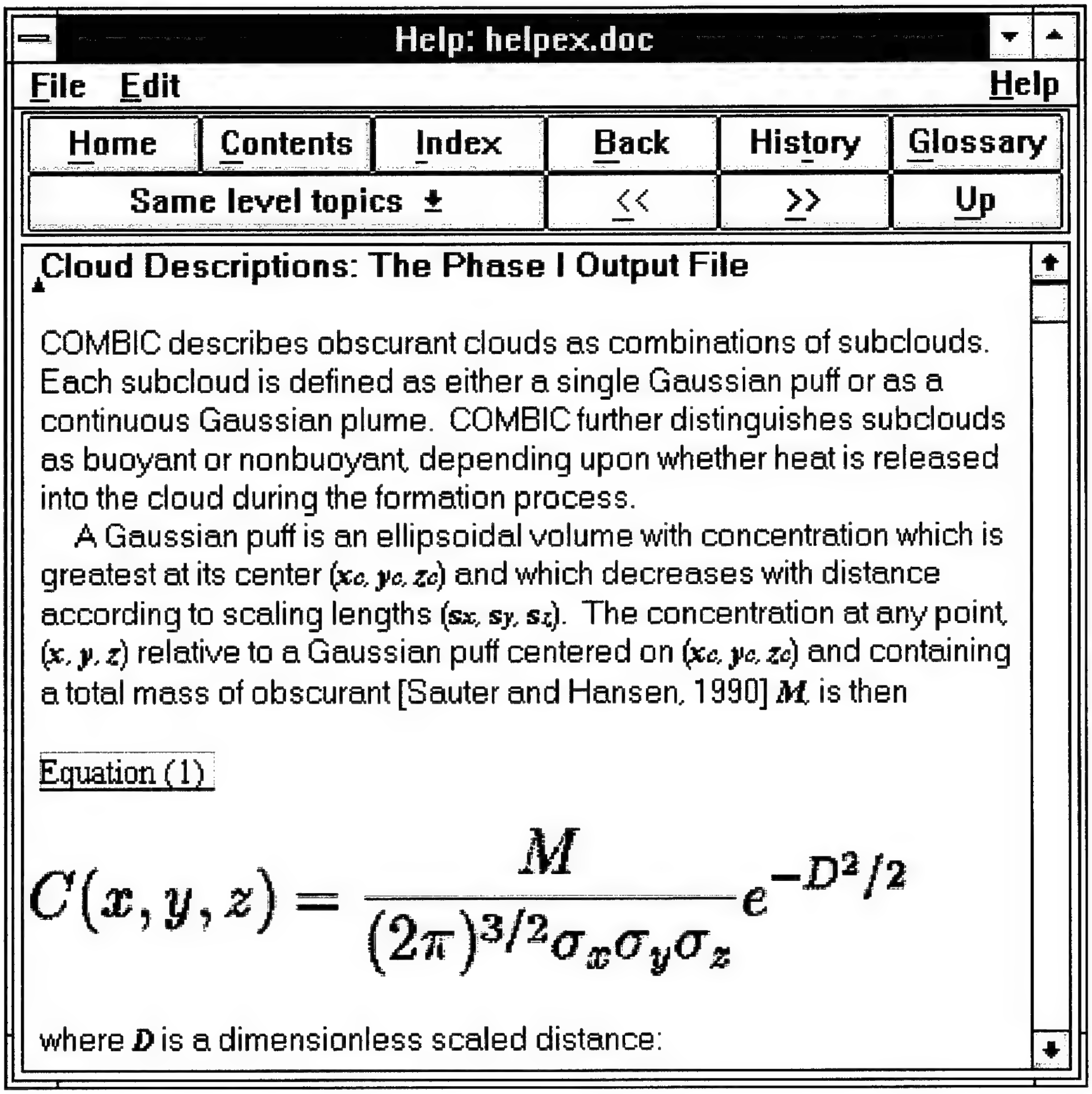
This was accomplished by editing the ASCII text file using Microsoft Word. The converter that was provided in the GUI development package allowed for shortcuts when setting up a help file using a common text editor like Microsoft Word. Commands were added to the Microsoft Word version and then saved in a rich text format (RTF). We then ran the RTF file through the converter which added additional commands before generating the flat text files that were used by the help engine. This text file can also be edited.

3.6.5.2 Graphics Manipulation

Figures were provided in gif file format. However, due to the low quality of the gif images, each figure was redrawn and colorized by our technical publications department.

Electronic versions of the tables were only provided in the postscript file format. In order to present high quality pictures of these tables, each table was regenerated by support staff using Microsoft Word and a graphics tool.

Electronic copies of the equations were also only provided in the postscript file. Several methods of separating the equations were investigated. First, each equation was reproduced using an equation editor. Late in the effort, extraction from the postscript file was investigated. Postscript viewers were used to view the file and save individual equations as gif files. Manipulation on these files were limited and scaling tricky. An example of an equation pulled from the postscript file is provided in Figure 15.



Cloud Descriptions: The Phase I Output File

COMBIC describes obscurant clouds as combinations of subclouds. Each subcloud is defined as either a single Gaussian puff or as a continuous Gaussian plume. COMBIC further distinguishes subclouds as buoyant or nonbuoyant, depending upon whether heat is released into the cloud during the formation process.

A Gaussian puff is an ellipsoidal volume with concentration which is greatest at its center (x_c, y_c, z_c) and which decreases with distance according to scaling lengths (s_x, s_y, s_z). The concentration at any point, (x, y, z) relative to a Gaussian puff centered on (x_c, y_c, z_c) and containing a total mass of obscurant [Sauter and Hansen, 1990] M, is then

Equation (1)

$$C(x,y,z) = \frac{M}{(2\pi)^{3/2}\sigma_x\sigma_y\sigma_z} e^{-D^2/2}$$

where D is a dimensionless scaled distance:

Figure 15. Postscript Equation Example

3.6.5.3 Detailed Help Window Button Descriptions

Figure 15 again shows an example of the help screen main window. As previously mentioned, various buttons are available to help the user navigate through the on-line help system. Each button and each type of colored text are covered in detail here.

Home

The Home button will return the user to the Welcome screen shown in Figure 14.

Contents

The Contents button opens a new window that lists all the topics as seen in Figure 16. The user can select a particular topic and display that topic in the main help window by double clicking the topic or selecting the topic and clicking the "Go to ..." button.

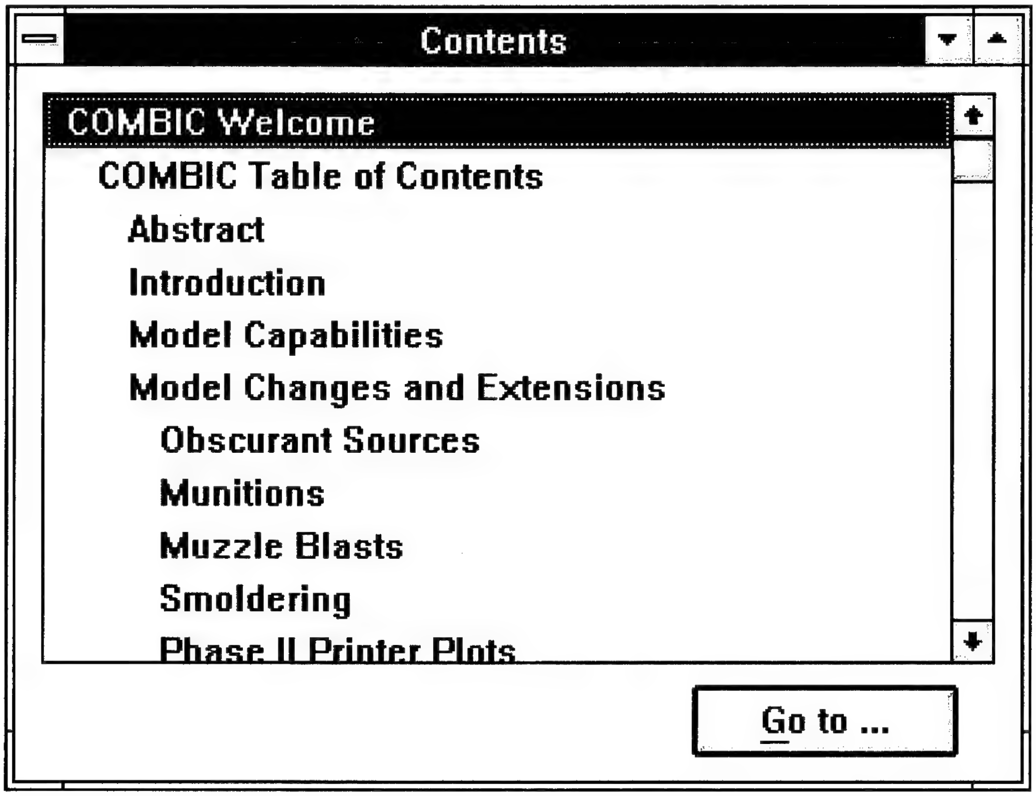


Figure 16. Help Contents Screen

Index

The Index button brings up an Index window, shown in Figure 17, that displays a list of keywords. This window is divided into two scrollable areas. The top portion of the window displays keywords that have been flagged as index entries. The bottom portion displays topics where the selected keyword is discussed. The user can then display in the main help window the selected topic by double clicking the topic or selecting the topic and clicking the "Goto ..." button.

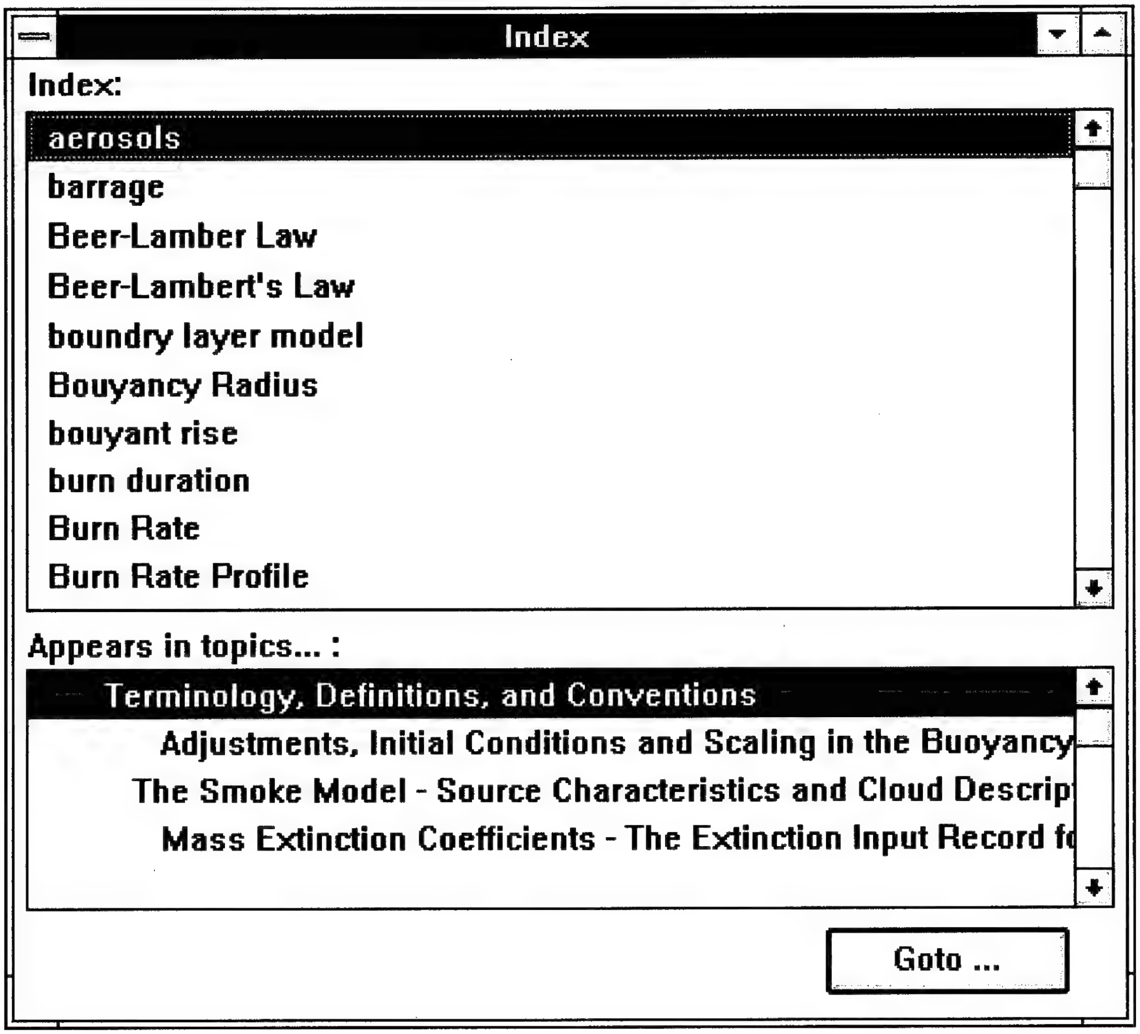


Figure 17. Help Index Screen

Back

The Back button will take the user to the last topic visited.

History

The History button will bring the History window that displays a chronological list of topics that the user has visited during this session, ordered from most recent visits at the top, to least recent visits at the bottom. This is shown in Figure 18. The user can return to any topic by double clicking the topic or by selecting the topic and clicking the "Go To .." button.

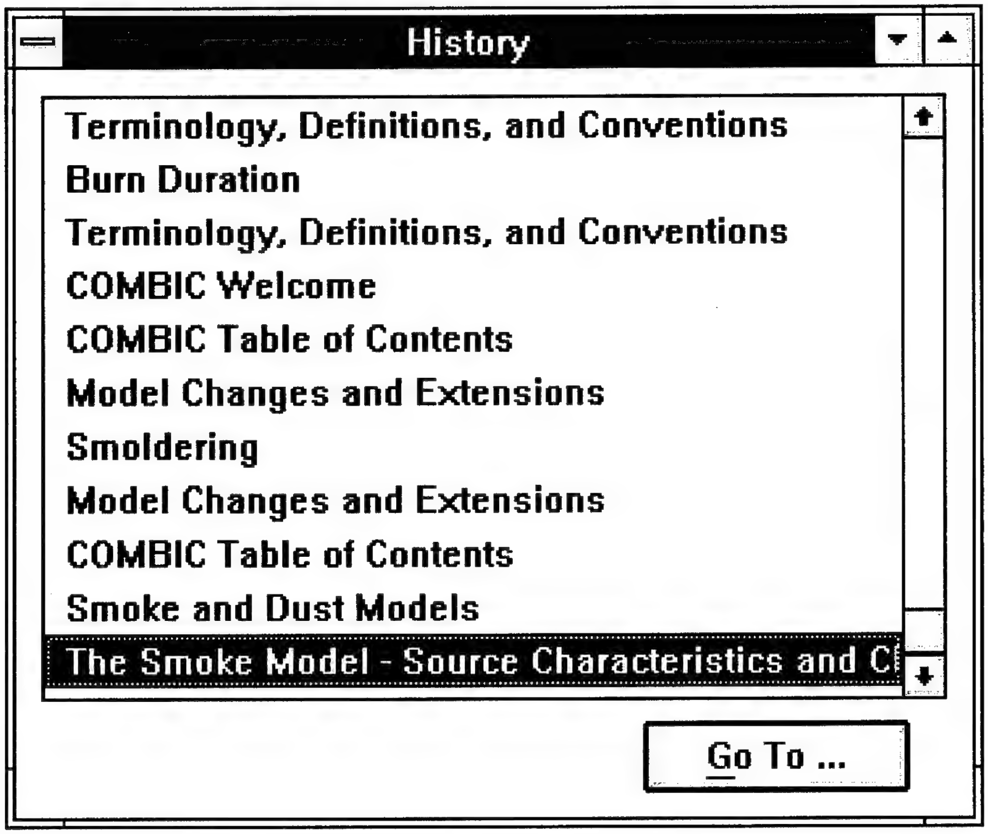


Figure 18. Help History Screen

Glossary

The Glossary button will open a glossary window as shown in Figure 19. The Glossary window displays an alphabetical list of all glossary words in a scrollable window. If the user clicks and holds the mouse button down on one of the terms, a glossary definition pops up in a temporary window. When the user releases the mouse button the temporary window will close.

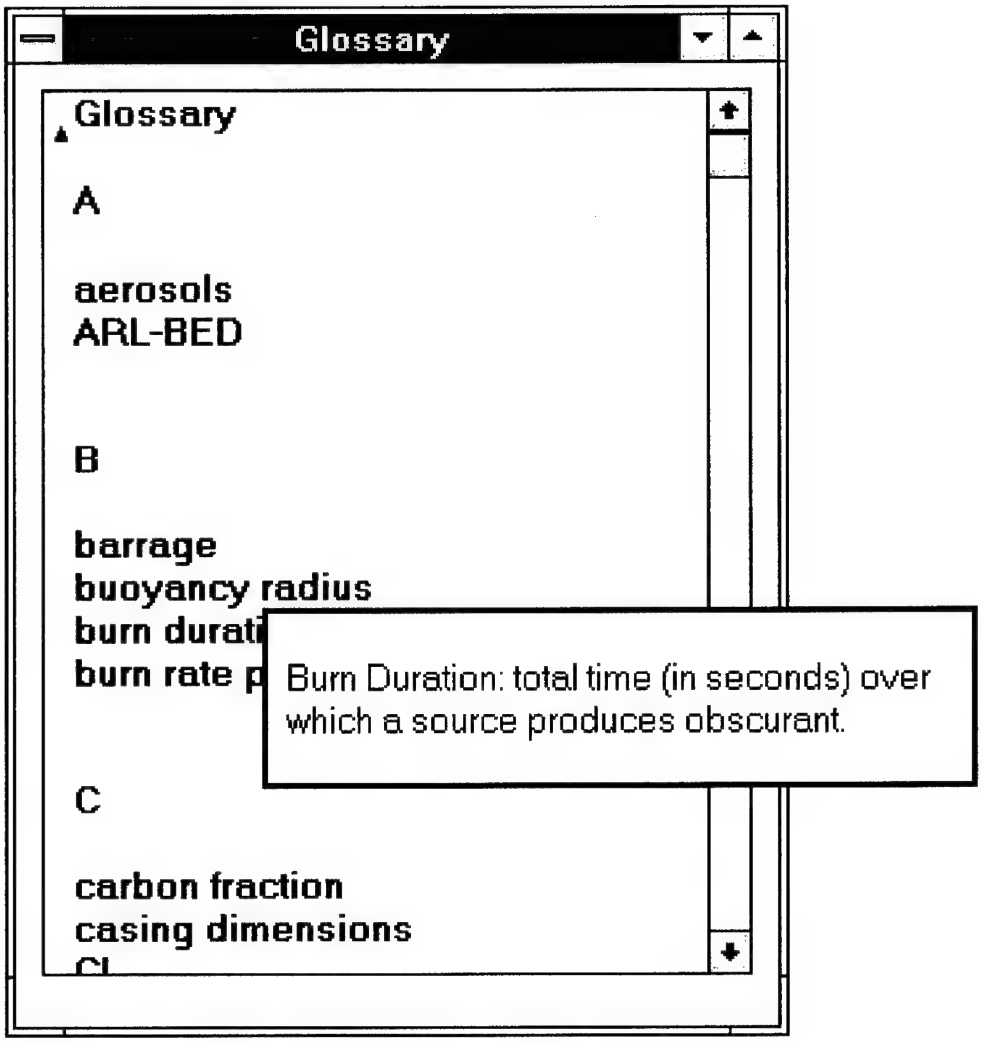


Figure 19. Help Glossary Screen

Pull Down Menu (Same Level Topics) and Arrows

The pull down menu defines how the arrow buttons behave. The choices are "See same level topics" and "See all topics". "See same level topics" causes the arrows to traverse only to topics at the same level as the current topic (sibling topics), skipping all lower level topics. "See all topics" causes the arrow button to traverse through all topics, lower level (children) topics and to higher level (parent) topics, in the order they appear in the Contents window.

Up

The Up button jumps the user to the parent topic of the current topic.

Colored Text Descriptions

Within the main help window the user will find color coded text. Colored text signifies an action or acts as a marker. The colored Text is described below and Figure 20 shows an example screen with colored text.

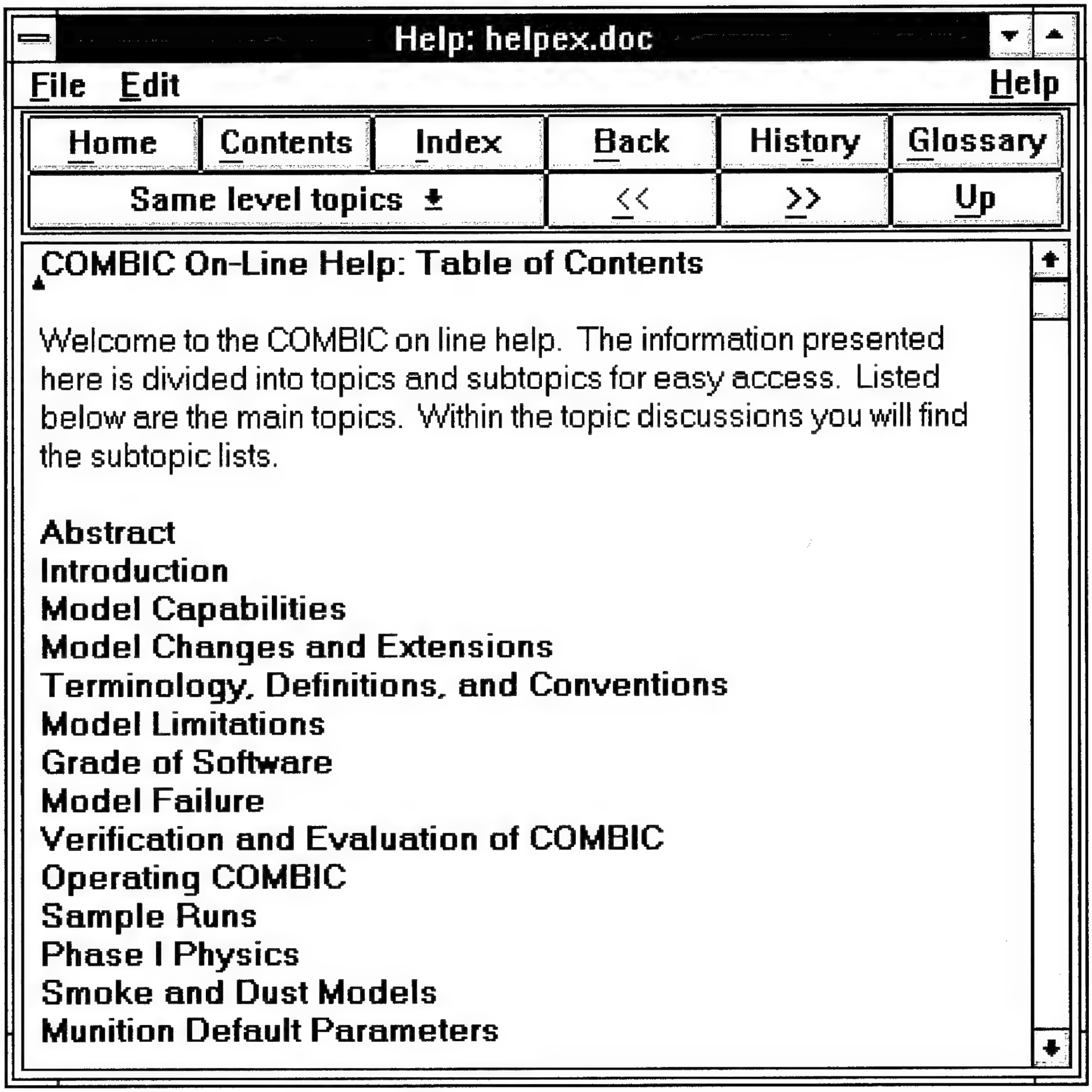


Figure 20. Help Window Welcome Screen

Black and Yellow

Black text with a Yellow back ground indicates the topic title. No action will take place when clicking this text.

Black

Where text is both Black and Bold and where the cursor also changes to a right pointing arrow when placed above this text, a pop up temporary window will appear if the mouse button is pressed. For example, the pop up window is often used to display a glossary definition or an acronym meaning and is the same type of temporary window used with the Glossary window. See Figure 21 for an example.

Blue

Blue text indicates a jump to another topic or label. Notice that the cursor will also change when above the BLUE text. Hint: to return to the last topic after choosing a jump, use the Back button.

Red

Red text, as shown in Figure 21, indicates a figure or table window can be displayed. Clicking on the red text will bring up a new window to display a figure, as illustrated in Figure 22, or a table. Notice that the cursor will also change. If an additional window is already open, the help will reuse that window. To get a new window hold down the control key when clicking on the red text. To close the window choose the Close button.

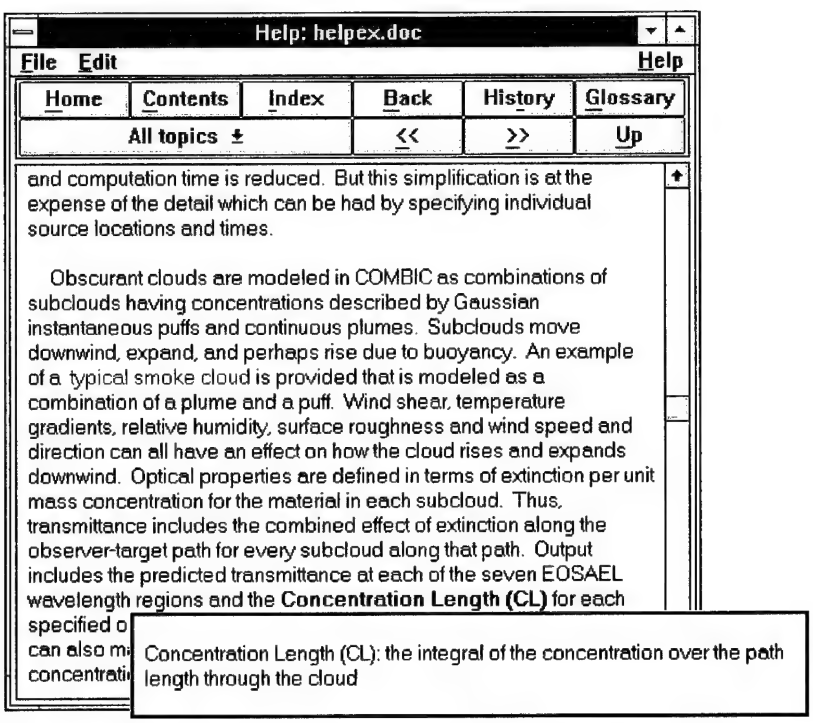


Figure 21. Help Screen Displaying Red, Blue and Bold Text

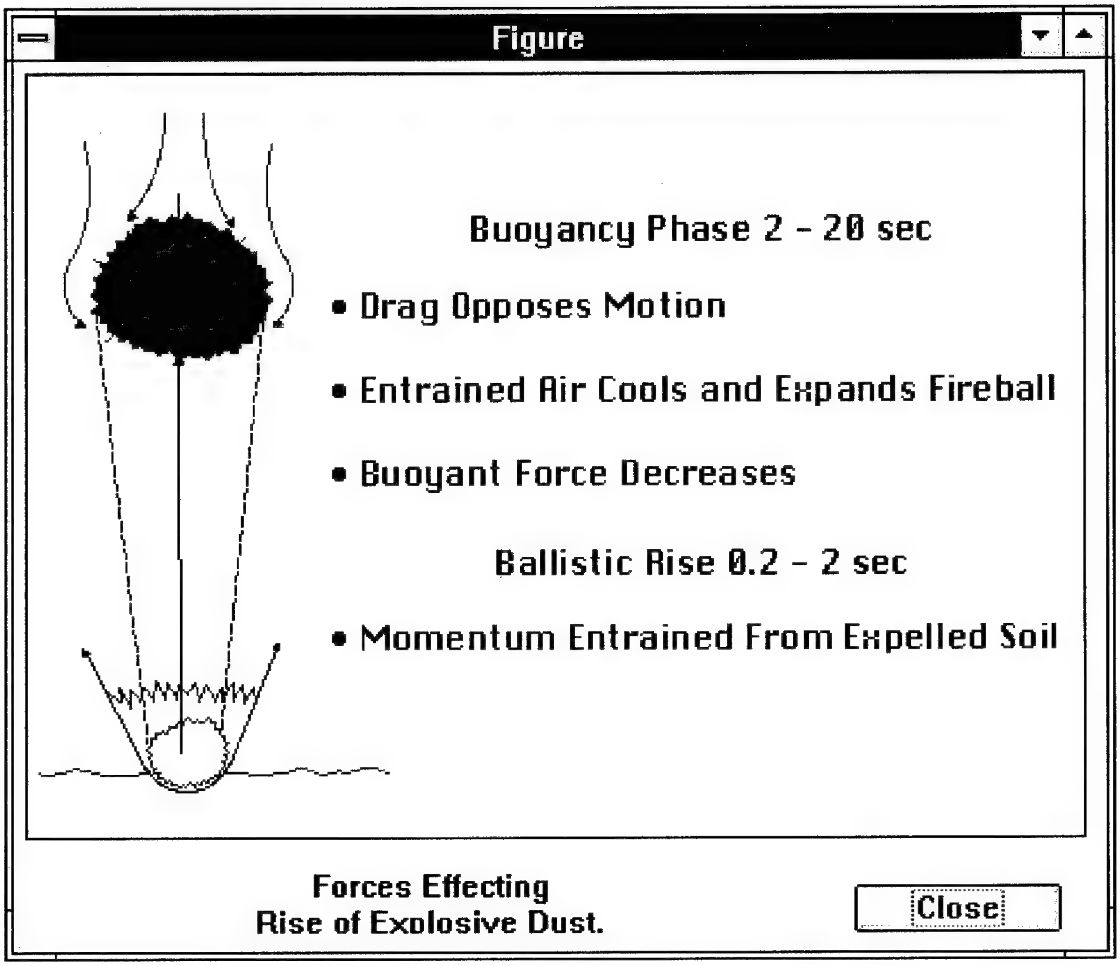


Figure 22. Help Figure Window

3.6.6 FORTRAN Issues

We learned during the COMBIC prototype development for our Phase I contract that certain changes to the EOSAEL code are required to successfully compile and link it with the C GUI. When we began the effort we used a simple approach to the multi-language problem. The C code was compiled with the C compiler to create a C object file and the EOSAEL code was compiled with the FORTRAN compiler creating FORTRAN object files. This worked fine for a long time in the development of the GUI. Very late into the development we encountered a problem with over running the 64k near data segment on the PC. This happened as more and more of the functionality was added to the GUI. The problem is that certain things like global variables, function declarations, window initialization routines, C and FORTRAN library codes have to go into this near data segment so they can

readily be found by all parts of the code. Where we had some control over the C portion of what went in there, we had no control over the FORTRAN. Each and every subroutine and function of the COMBIC EOSAEL code was being loaded into a different segment of the near data. To solve this problem, we placed the EOSAEL routines into a Dynamic Linked Library (DLL). By doing this, it removed all of the FORTRAN code from the near data segment and by being dynamically linked loaded them into a different section of memory when they were needed.

Limitations of DLLs forced certain changes to the FORTRAN routines. In particular, any manipulation of direct access files (opening, closing, reading, or writing) had to be replaced by the use of interfaces to the Windows API C routines *_lcreat, _lopen, _lclose, _llseek, _hread, and _hwrite.* Since these routines use byte addressing, it was necessary to pass the data to them in character arrays, rather than numeric arrays. This was accomplished by using FORTRAN EQUIVALENCE statements to assign character arrays to the same storage locations as the numeric arrays used to buffer the data to/from the direct access files. The record number used for each direct access read or write was converted to the corresponding byte address before calling *_llseek* to position the file.

Also, it is illegal to stop execution within a DLL, so any STOP statements within the EOSAEL code were replaced with RETURN statements (if a labeled STOP was used, the label was printed to the primary output file prior to the RETURN statement). Finally, any files that were accessed within EOSAEL had to be opened and closed explicitly within the DLL. We wrote simple interface routines for COMBIC to open and close the primary output file.

To test that the changes made, did not affect the results of the COMBIC code, SPARTA ran the COMBIC User's Guide examples with the DLL version of COMBIC and a non-GUI version of COMBIC. We had perfect matches in all four cases. SPARTA verified that these cases were comprehensive enough to have exercised all areas of the code that were changed to accommodate the direct access read/writes. Note: The DLL version and the non-GUI version results matched, they however did not match the results in the printed document. We are certain this is related to the fact that we had to remove the -Fpi87 compiler option from the DLL compile. This affects how the floating point mathematics is handled. The final answers did not match, but they were off by less than a percent. The non-GUI version was also compiled without -Fpi87 and the fact that the two give exact answers backs up our belief that this is the reason.

3.7 Place and Execute the COMBIC Prototype on a CD ROM

SPARTA, Inc. purchased and used a software package by Stirling Technologies to generate a professional installation routine for COMBIC. With this software, we were able to set up COMBIC to install and run from the user's hard-drive or run from the CD. This software also automatically generates an uninstall routine.

Once the setup routine was created and tested, SPARTA used internal resources to record the CD. For COMBIC, this was a simple process with COMBIC only requiring 10 MB of the CD ROM. Through this effort, it was clearly seen how this process could be applied and modified to the complete EOSAEL installation. Example setup screens are shown if Figures 23 and 24.

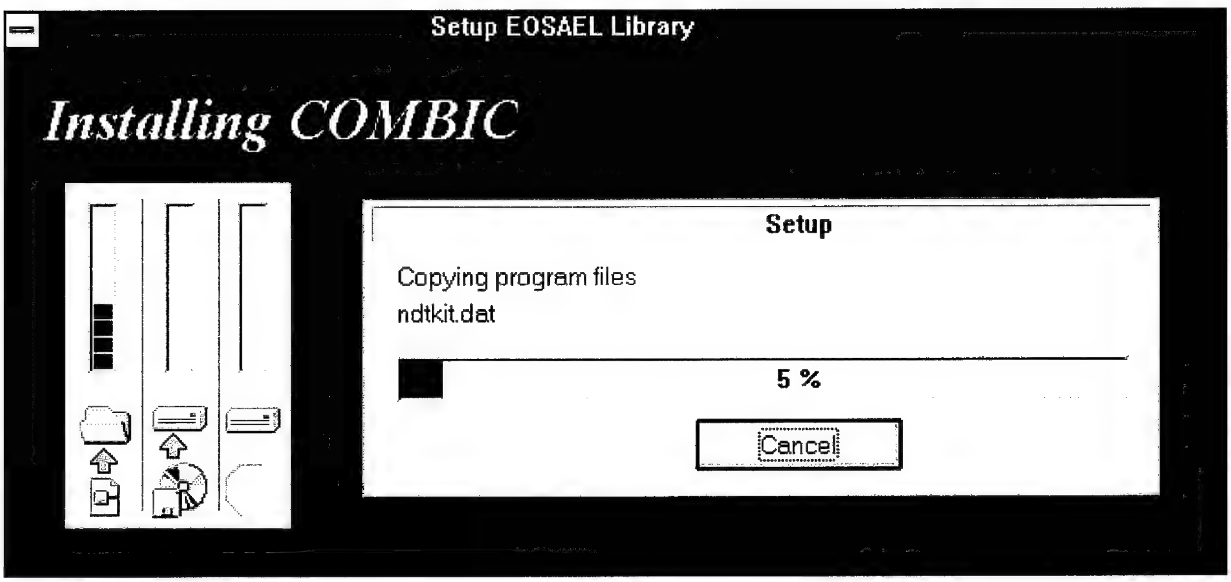


Figure 23. Installation Option Screen

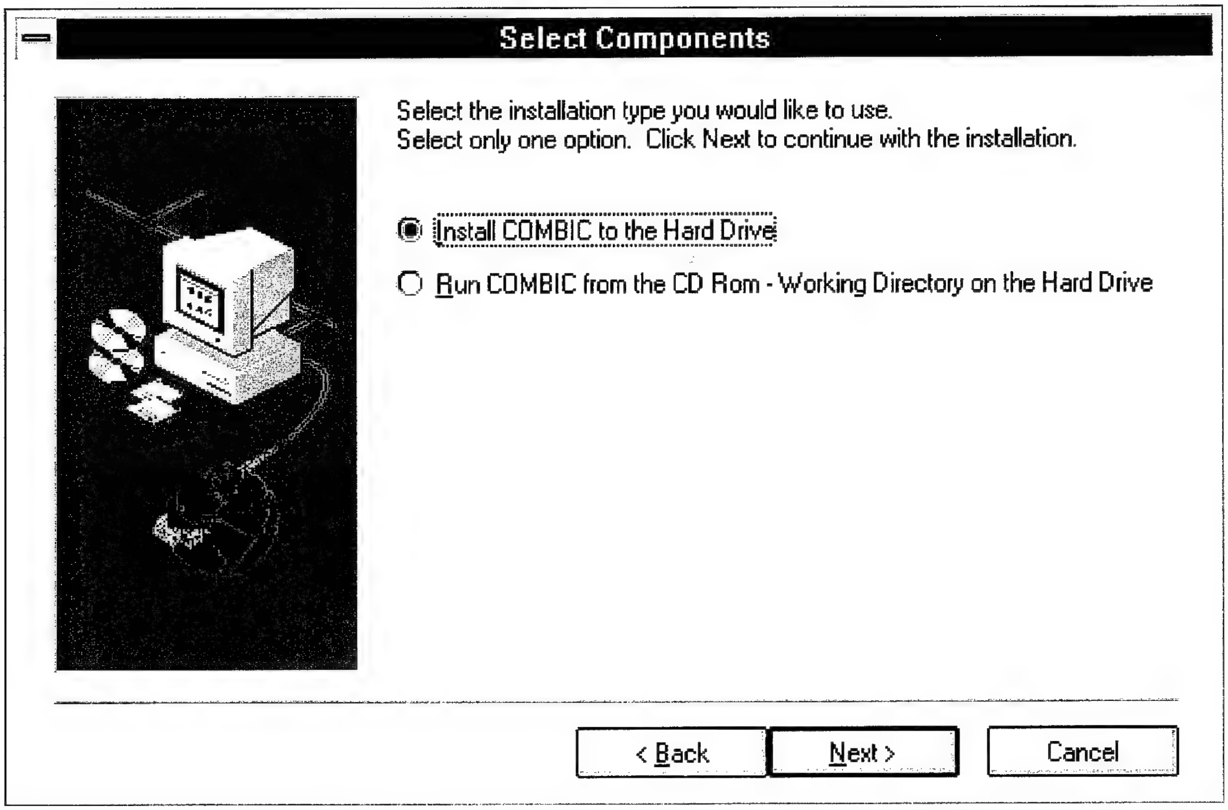


Figure 24. Decompress Scress

4.0 Results of Phase I Effort

The objectives of the Phase I effort were to (1) develop a plan to interface all EOSAEL modules to a PC/Windows environment, (2) plan the Graphical User Interface (GUI) front ends for each module, (3) create unique identifiable icons for each module, (4) develop a prototype for the Combined Obscuration Model for Battlefield Induced Contaminants (COMBIC) module, and (5) install and execute the COMBIC prototype Windows application on a CD ROM. We have accomplished these objective as our discussions in Section 2 will support. However, we also accomplished a very important secondary objective by providing cross-platform capability for the COMBIC/GUI prototype by using Neuron Data's Open Interface toolkit to develop the required Graphical User Interface (GUI).

Specific accomplishments of the Phase I effort are as follows:

(1) We designed and produced a graphical icon for each of the EOSAEL modules that visually portrays the physical phenomenon represented in the module.

(2) We designed GUIs for all the modules that organize the inputs into logically partitioned input screens and provide simple 'point and click' access to all the inputs.

(3) We implemented the GUI for COMBIC and successfully integrated it with the COMBIC FORTRAN code, verifying that it produced output identical to that produced by the card-image input version of COMBIC.

(4) We incorporated a comprehensive on-line help capability into COMBIC, including context sensitive help windows and a complete user's manual with hypertext for accessing topics of interest and pop-up windows for figures and equations. When the cursor is moved over an area for which context sensitive help is available, a visible change in the appearance of the cursor occurs as a signal to the user.

(5) We demonstrated cross-platform capability of the COMBIC/GUI prototype by installing and executing it on Macintosh and Sun UNIX platforms, generating identical COMBIC input files to that produced in the PC/Windows environment.

(6) We recorded the enhanced COMBIC on a CD ROM and successfully executed the program from the CD ROM.

5.0 Technical Feasibility for Completing all EOSAEL Interfaces

We have demonstrated the soundness of our technical approach for interfacing all of the EOSAEL modules by successfully applying our approach to the COMBIC module. We have produced a multi-language program with the Windows interface routines written in C to provide all the program's calls to the Windows Applied Programming Interface (API) library and the COMBIC module of the EOSAEL family of models remaining essentially unchanged (with the exception of certain changes in direct access file addressing and program control required by the Microsoft C/FORTRAN interface) in FORTRAN to provide the computational services of the COMBIC module and to perform file input and output required of COMBIC. COMBIC is among the most complex of the EOSAEL modules. Therefore, the success of the COMBIC/GUI prototype development and CD ROM installation establishes the feasibility of GUI development for the entire EOSAEL suite.

APPENDIX A

Draft Module Interface Design

Appendix A
List of Figures

A.1 Broadband Integrated Transmittances (BITS) Module

The Broadband Integrated Transmittances (BITS) module provides exact transmittance calculations for broadband systems operating in the ultraviolet through the far-infrared spectral regions by accounting for spectral dependence of the Beer-Lambert law across system bands. The user can specify data for multiple runs. BITS can optionally use a LOWTRN output file as Atmospheric input and optionally use a COMBIC output file as Concentration Length input. These options are described below in the Atmospheric Transmittance screen section and the Concentration Length screen section. Figure A-1 shows the Input Menu Choices. BITS input screens are Case Name, Waveband, Atmospheric Transmittance, Spectral Signature of Target, Detector Spectral Response, Filter Spectral Response, System Optics Spectral Response, and Concentration Length.

BITS

Input Menu
Case Name
Waveband
Mass Extinction Coefficient
Atmospheric Transmittance
Spectral Signature of Target
Detector Spectral Response
Filter Spectral Response
System Optics Spectral Response
Concentration Length

Figure A-1. BITS Input Menu Choices

The Case Name screen, shown in A-2, incorporates data from the NAME card. This screen gives the user the opportunity to name this particular case for future reference. These data are not required.

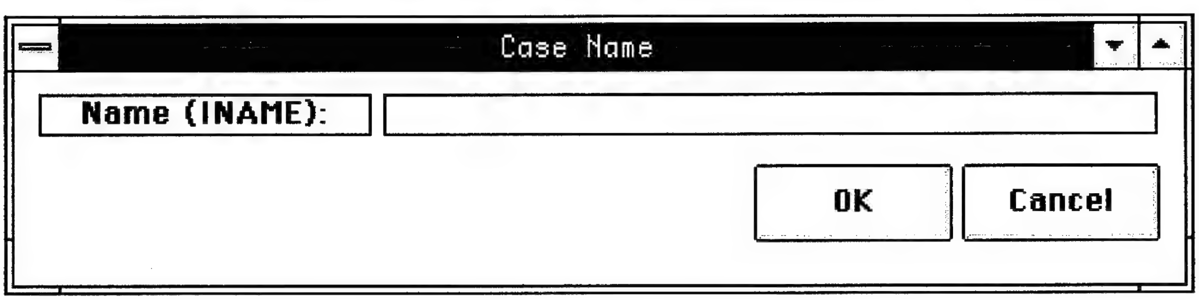


Figure A-2. BITS Case Name Screen

The Waveband screen, shown in A-3, incorporates data from the BAND card. These data are required.

Waveband

Parameter	Code Variable	Units	User Values
Short -wavelength Limit	IAERO	µm	
Long-wavelength Limit	RD	µm	
Spectral Resolution	RNRT	µm	

OK Cancel

Figure A-3. BITS Waveband Screen

The Mass Extinction Coefficient screen, shown in A-4, incorporates data from the ALFA, EXTR, and EXTQ cards. Parameter Units, Wavelength, and Atmospheric Transmittance are dependent on the choice of the first parameter. These parameters will only become active when applicable. Active data on this screen are required.

Parameter	Code Variable	Units	User Values
Mass Extinction Coefficient as a Function of Wavelength Option	IOPTN	-	User Input
Parameter Units	IUNIT	-	◉ µm ○ cm^{-1}

Wavelength (µm)	Mass Extinction Coefficient (µm)	Wavelength (µm)	Mass Extinction Coefficient (µm)

OK Cancel

Figure A-4. BITS Mass Extinction Coefficient Screen

The Atmospheric Transmittance screen, shown in A-5, incorporates data from the ATMO, ATMR, and ATMQ cards. Parameters 2-6, Wavelength, and Atmospheric Transmittance are dependent on the choice of the first parameter. These parameters will only become active when applicable. If the user chooses to use a LOWTRN data output file, specified by the first parameter, the user will have the option to specify an existing LOWTRN output file or specify LOWTRN data for a new run and use this new output data as input. Active data on this screen are required.

Parameter	Code Variable	Units	User Values
Atmospheric Transmittances as a Function of Wavelength Option	IOPTN	-	User Input
Parameter Units	IUNIT	-	◉ µm ○ cm^{-1}
Number of Header Lines	NHEAD	-	
Wavelengths Column Number	WVCOL	-	
Atmospheric Transmittances Column Number	TRNCOL	-	
Filename	LFLE	-	

Wavelength (µm)	Atmospheric Transmittance (µm)	Wavelength (µm)	Atmospheric Transmittance (µm)

OK Cancel

Figure A-5. BITS Atmospheric Transmittance Screen

The Spectral Signature of Target screen, shown in A-6, incorporates data from the TRGT, TGTR, and TGTQ cards. Parameters 2-3, Wavelength and Target Signal are dependent on the choice of the first parameter. These parameters will only become active when applicable. Active data on this screen are required.

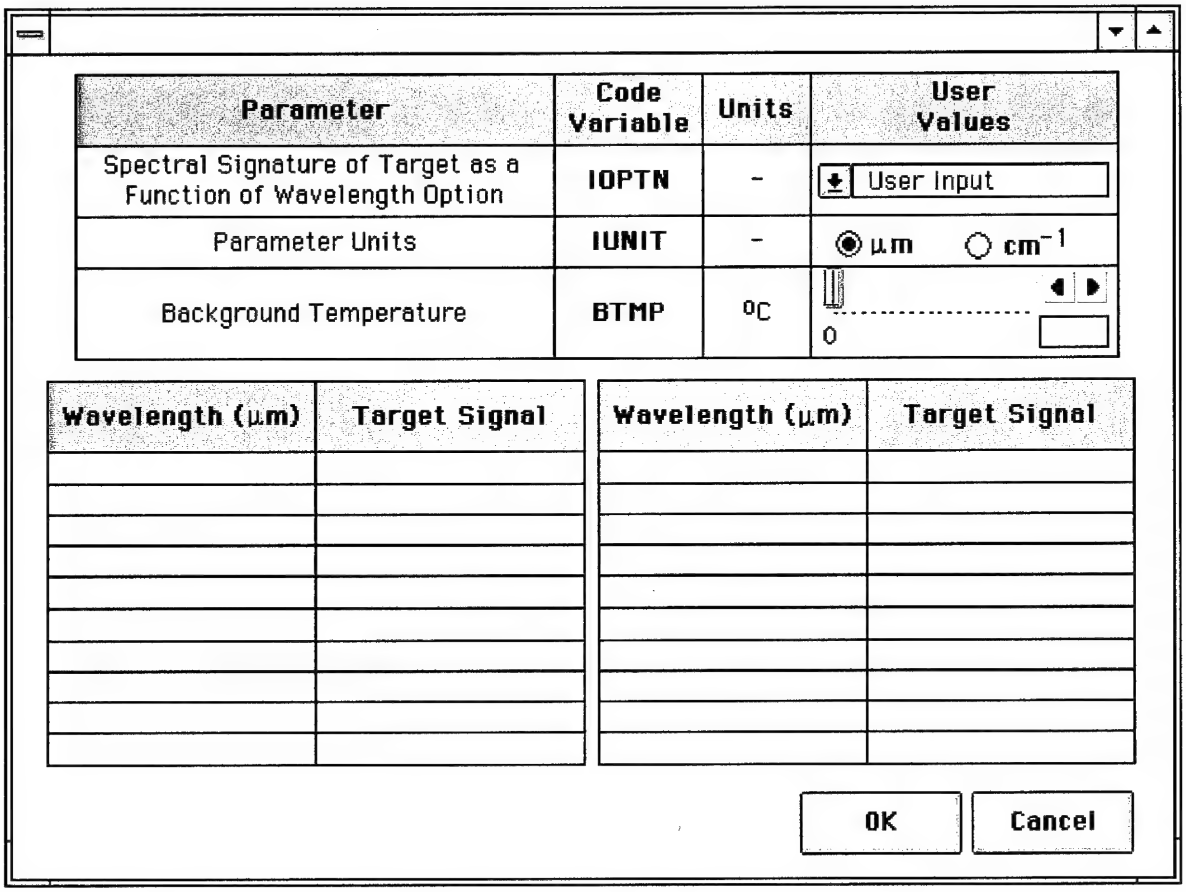


Figure A-6. BITS Spectral Signature of Target Screen

The Detector Spectral Response screen, shown in Figure A-7, incorporates data from the DECT, DETR, and DETQ cards. Parameter Unit, Wavelength, and Detector Response are dependent on the choice of the first parameter. These parameters will only become active when applicable.

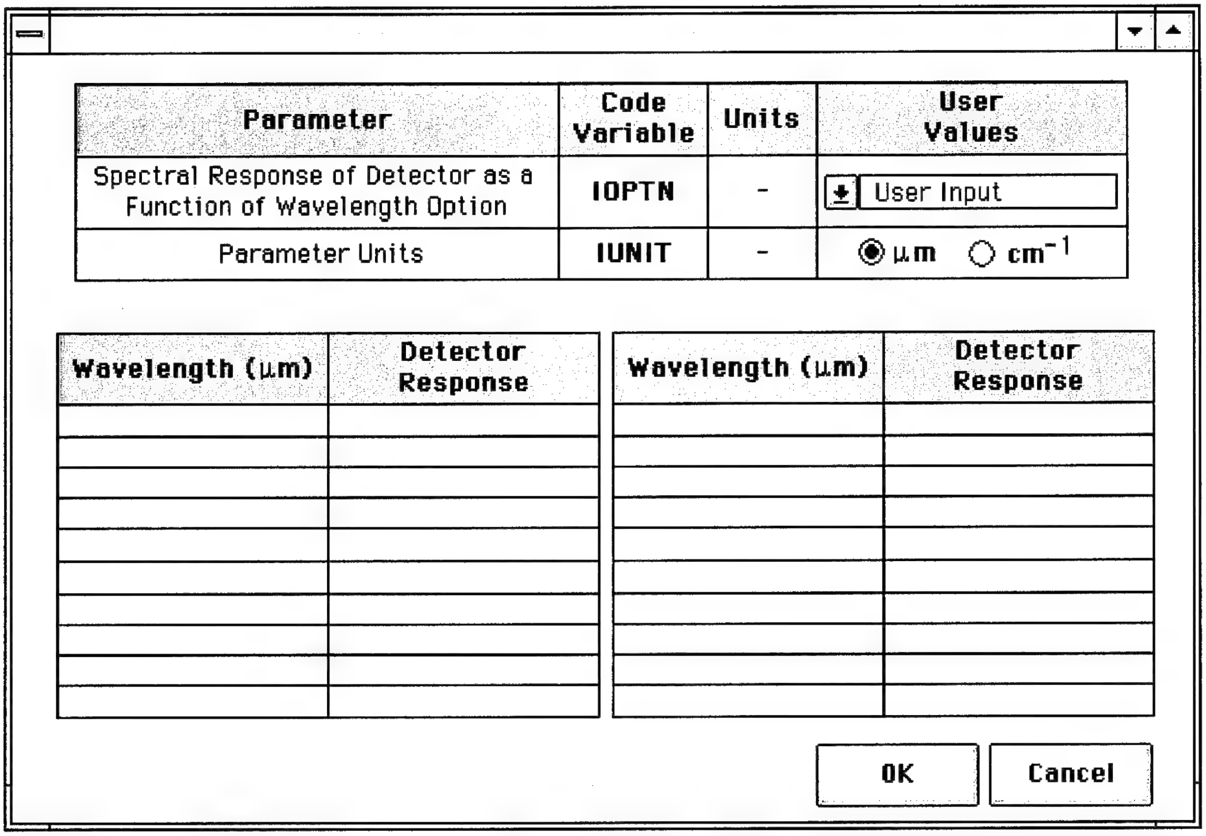


Figure A-7. BITS Detector Spectral Response Screen

The Filter Spectral Response screen, shown in Figure A-8, incorporates data from the FILT, FILR, and FILQ cards. Parameter, Wavelength, and Filter Response are dependent on the choice of the first parameter. These parameters will only become active when applicable. Active data on this screen are required.

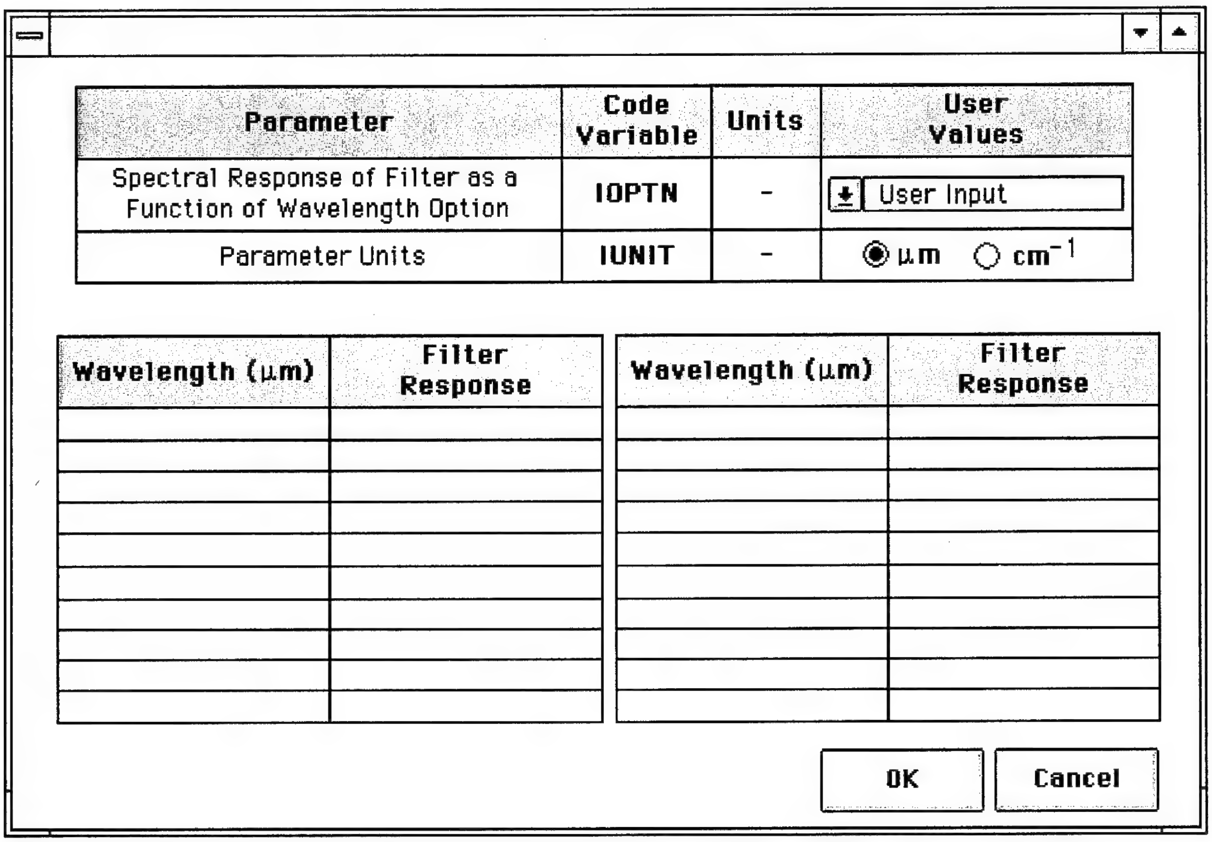


Figure A-8. BITS Filter Spectral Response Screen

The System Optics Spectral Response screen, shown in Figure A-9, incorporates data from the SYSM, SYSR, and SYSQ cards. Parameter, Wavelength, and System Optics Response are dependent on the choice of the first parameter. These parameters will only become active when applicable. Active data on this card are required.

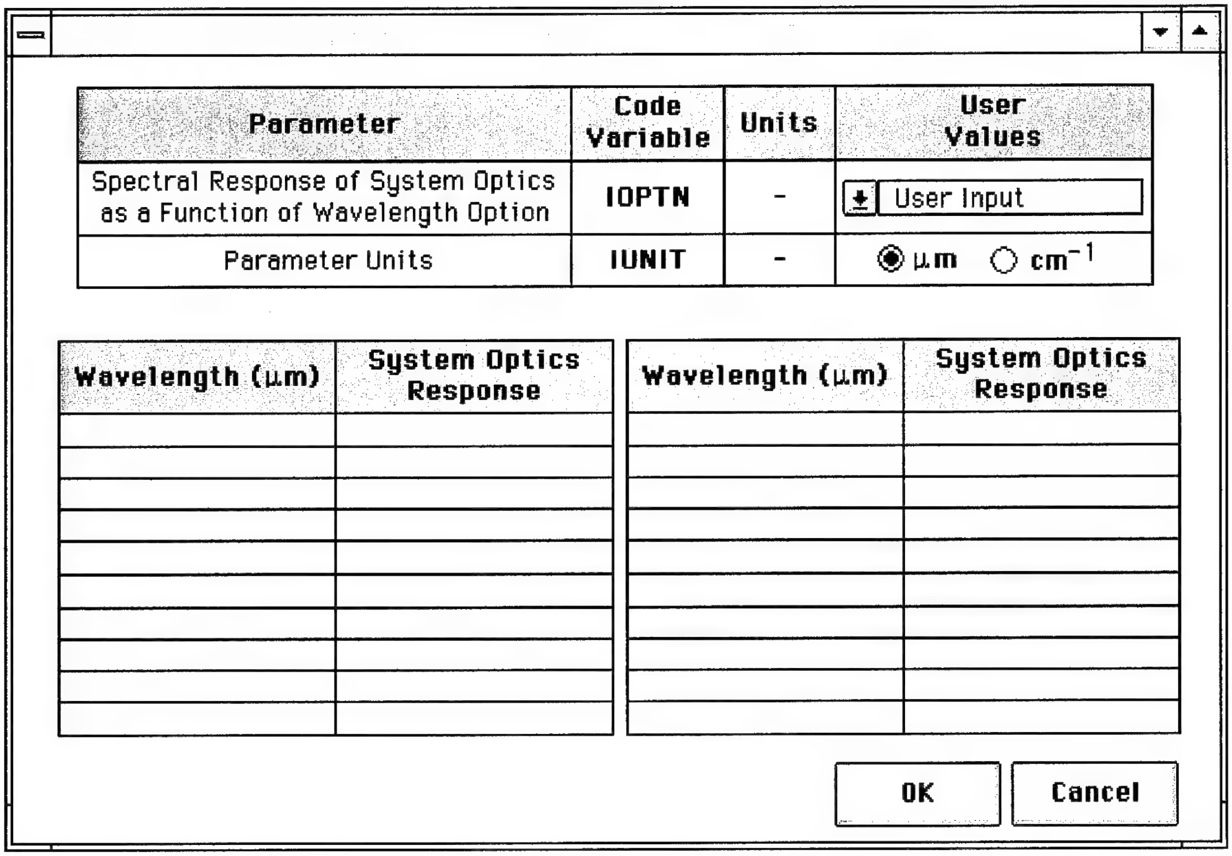


Figure A-9. BITS System Optics Spectral Response Screen

The Concentration Length screen, shown in Figure A-10, incorporates data from the CONL, CONR, and CONQ cards. Parameters 2-5, Time, and Concentration Length are dependent on the choice of the first parameter. These parameters will only become active when applicable. If the user chooses to use a COMBIC data output file, specified by the first parameter, the user can either specify an existing output file or specify COMBIC data for a new run and use this new output file as input. Active data on this card are required.

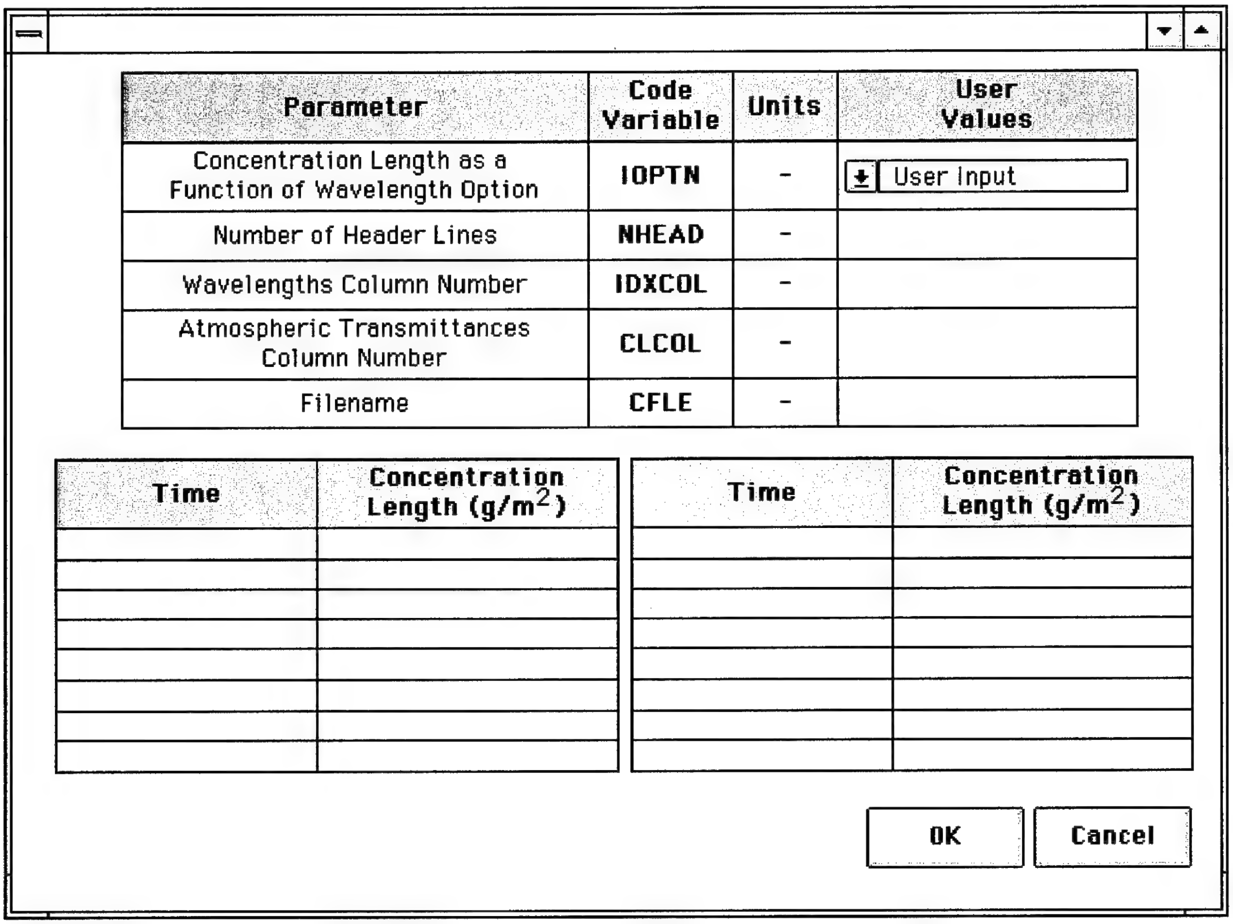


Figure A-10. BITS Concentration Length Screen

A.2 Climatology (CLIMAT) Module

The Climatology (CLIMAT) module calculates and provides climatology data in both a standalone mode and as input to other modules. The user can specify data for multiple runs. The CLIMAT documentation indicates that CLIMAT generated data can supply input to all other modules. However, some modules, do not indicate whether that is an option. An example of this is the COPTER module. Where the potential to use CLIMAT is present, we have assumed that this will be implemented as part of Phase II. Figure A-11 shows the CLIMAT Input Menu Choices. All input is captured in one screen, the Climatology Data Screen.

CLIMAT

Input Menu
Climatology Data

Figure A-11. CLIMAT Input Menu Choices

Figure A-12 shows the Climatology Input screen and incorporates all the variables found on the CLIMAT card. The Climatology Data Flag (ICLMAT) can be overruled by other modules. When specifying data for each module where climatology data is used, the user can choose then whether to use user specified data or use CLIMAT data.

Climatology Data

Parameter	Code Variable	User Values
Climatology Data Flag	ICLMAT	○ Use CLIMAT Data ○ Use User Input
Region	LOCAT	Alaskan Southern Coast
Climatology Class	ICLASS	Fog, haze, and mist with visibility < 1 km.
Month	MONTH	January
Hour	NHOUR	0
Print Selector	NPRT	○ Do Not Print ○ Print All Available

OK Cancel

Figure A-12. CLIMAT Climatology Data Screen

A.3 Obsuration Due to Helicopter Lofted Snow and Dust (COPTER) Module

Obsuration due to helicopter lofted snow and dust (COPTER) module calculates obscuration as a function of time due to snow or dust lofted by the downwash of a passing helicopter. The user may specify data for multiple runs. The Wavelength is required and should be specified by the EOEXEC drivers wavelength screen. Figure A-13 shows the Input Menu Choices. COPTER input screens are Time Specifications, Helicopter Type and Path, Surface Condition, Transceiver and Receiver Coordinates, Meteorological Data, and Output Specifications.

COPTER

Input Menu
Time Specifications
Helicopter Type and Path
Surface Condition
Transceiver and Receiver Coordinates
Meteorological Data
Output Specification

Figure A-13. COPTER Input Menu Choices

The Time Specifications screen captures the same data the TIME card captured. Data on this card are required. When these data are not defined, the default values will be used. Figure A-14 illustrates the Time Specifications screen.

Time Specifications

Parameter	Code Variable	Units	Values
Start Time	TSTART	s	0
Time Increment	TINC	s	1
Time End	TEND	s	When the transmission returns to normal

OK Cancel

Figure A-14. COPTER Time Specifications Screen

The HELI and PATH cards are combined on the Helicopter Type and Path screen and is illustrated in Figure A-15. The parameters Mission Weight/Mass, Rotor Diameter and Number of Rotors are dependent on the choice of the Helicopter Type. The user will be unable to change these values unless the Helicopter Type is "Special Case". Then these variables will need to be specified by the user. Data from this screen are required.

Helicopter Type and Characteristics

Parameter	Code Variable	Units	User Values
Helicopter Type	HCODE	-	UH1H Iroquois
Mission Weight/Mass	HMASS	kg	4100
Rotor Diameter	ROTDIA	m	14.63
Number of Rotors	ROTNUM	-	1

Helicopter Position and Path Data

Parameter		Code Variable	Units	User Values
Starting Position	X	HXSTRT	m	
	Y	HYSTRT	m	
	Z	HZSTRT	m	
Heading		HDIR	degrees	
Ground Speed		HSPEED	m/s	

OK Cancel

Figure A-15. COPTER Helicopter Type and Path Screen

The Surface Condition screen captures the SNOW and DUST cards and is shown in Figures A-16 and A-17. The user must specify either the Snow or Dust parameters. The first parameter will change based on this choice. Data on this screen are required.

Surface Condition (Snow)

Specify ... ○ **Snow** ○ **Dust**

Parameter		**Code Variable**	**User Values**
Surface Condition		**SNOCOD**	
Scaling Transmission or Extinction Ratio for Each Band:	3 µm to 5 µm	**EXRMIR**	
	8 µm to 12 µm	**EXRFIR**	
Millimeter Wavelength of Interest		**WAVMN**	

OK **Cancel**

Figure A-16. COPTER Surface Condition (Snow)

Surface Condition (Dust)

Specify ... ○ **Snow** ○ **Dust**

Parameter		**Code Variable**	**User Values**
Surface Condition		**DSTCOD**	
Scaling Transmission or Extinction Ratio for Each Band:	3 µm to 5 µm	**EXRMIR**	
	8 µm to 12 µm	**EXRFIR**	
Millimeter Wavelength of Interest		**WAVMN**	

OK **Cancel**

Figure A-17. COPTER Surface Conditions (Dust)

The Transceiver and Receiver Coordinates screen captures data found on the GEOM card. Audits shown in Figure A-18. The transceiver and receiver coordinates along with the helicopter starting position could be specified as a point and click lay down as in COMBIC. An example is described in the COMBIC Module Prototype Development section, Section 3.6. This implementation decision will be determined in Phase II. Data on this screen are required.

Receiver and Transmitter Coordinates

Parameter		Code Variable	Units	User Values
Receiver Position	X	RCOORD(1)	km	
	Y	RCOORD(2)	km	
	Z	RCOORD(3)	km	
Transmitter Position	X	TCOORD(1)	km	
	Y	TCOORD(2)	km	
	Z	TCOORD(3)	km	

OK Cancel

Figure A-18. COPTER Transceiver and Receiver Coordinates Screen

The Meteorological Data input screen shown in Figure A-19 allows the user to specify whether to use CLIMAT data or user specified data. When the user chooses to use CLIMAT data, applicable parameters will become inactive. This screen captures the METR card and is required. Note that based on the current documentation, COPTER does not specify that input from CLIMAT can be used but the potential is present to do so. This implementation assumes this capability will be added in Phase II.

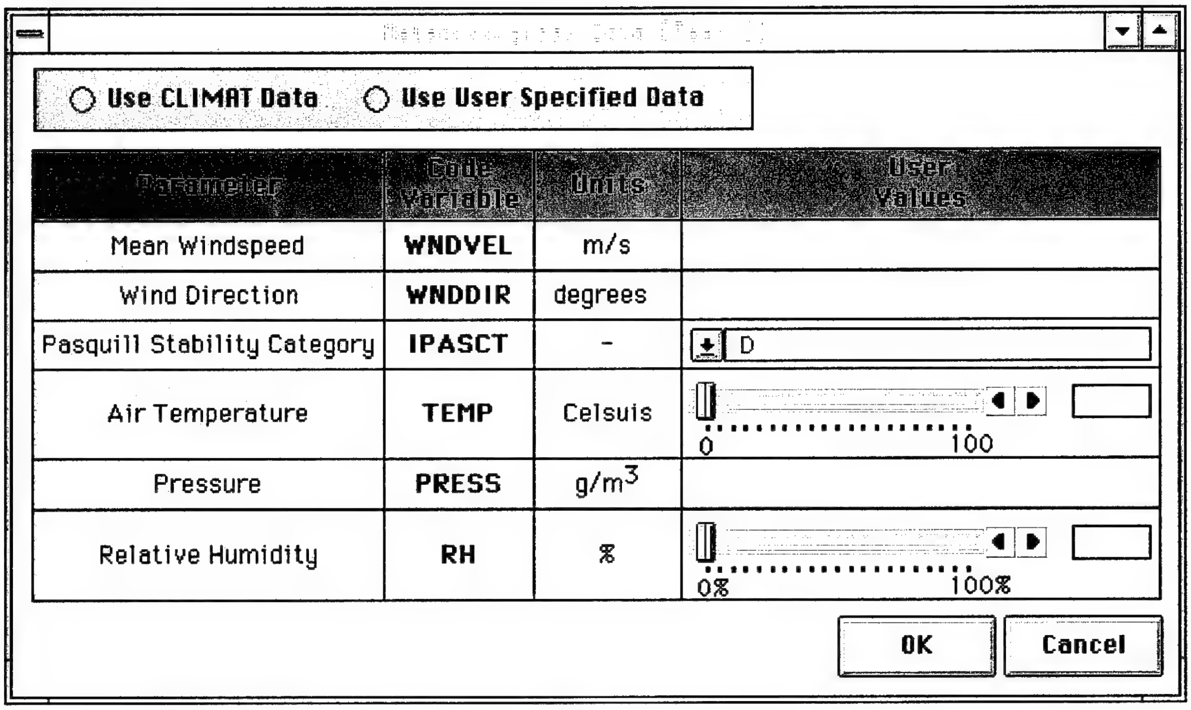


Figure A-19. COPTER Meteorological Data Screen

Figure A-20 shows the Output Specification screen and captures the PLOT and TXTP cards. This screen is optional and if not specified, defaults will be used.

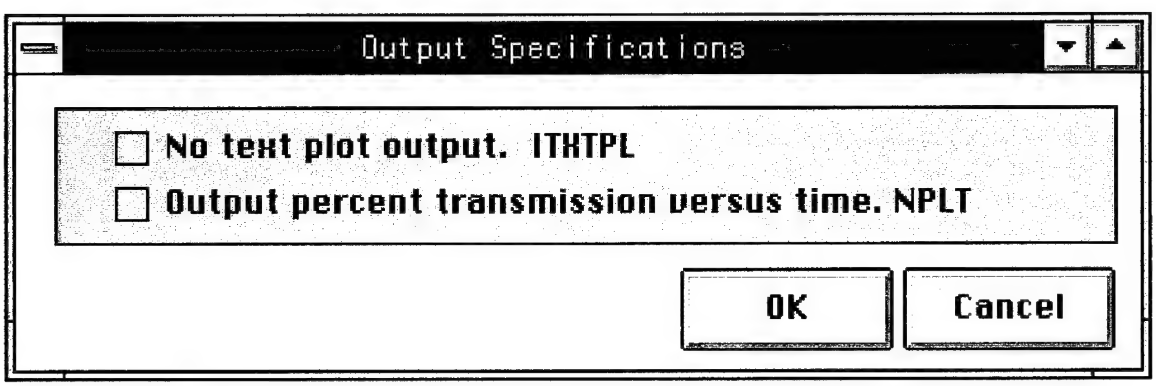


Figure A-20. COPTER Output Specification Screen

A.4 Fast Atmospheric Scattering (FASCAT) Model

The FASCAT module is a fast atmospheric scattering model for calculating apparent background and target radiance fields. Under the card system, multiple runs were not supported, this option to run multiple scenarios could be added and will be an implementation decision made in Phase II. FASCAT can optionally use LOWTRN aerosol models to construct data entries for the optical profiles. See the optical profiles section below for more details. Figure A-21 shows the Input Menu Choices. FASCAT input screens are Title, Run and Output Options, Background Component, Location, Date and Time, Extraterrestrial Solar Irradiance, Azimuth Viewing Angles, Zenith Viewing Angles, Optical Profiles, Beta Angle and Phase Function, Cloud Layer Information, Sensor and Target Combinations, and Upward Path of Sight.

FASCAT

Input Menu
Run and Output Options
Date, Time and Location
Background Component
Azimuth Viewing Angles
Zenith Viewing Angles
Optical Profiles → Beta Angle and Phase Functions
Cloud Layer Information
Sensor and Target Combinations
Upward Path of Sight

Figure A-21. FASCAT Input Menu Choices

The Title screen is shown in Figure A-22 and incorporates data from the TITLE card. Data from this screen is not required and is present as a convenience to the user.

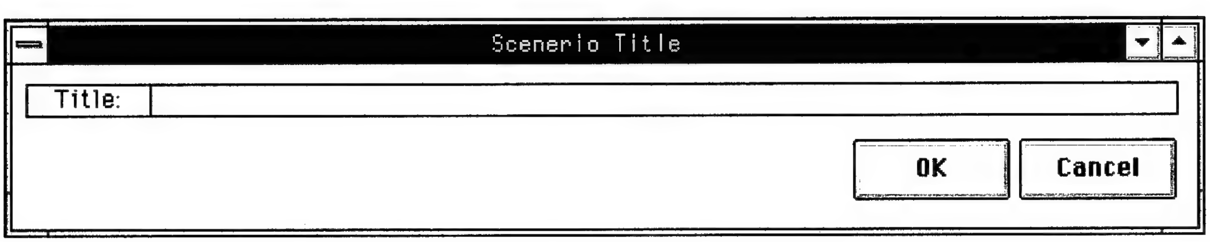


Figure A-22. FASCAT Title Screen

The Run and Output Options screen is shown in Figure A-23 and incorporates data from the IPRF card.

Run and Output Options

Parameter	Code Variable	Units	User Values
Print Option	IPRINT	-	○ Ignore ○ Activate
Store Option	ISTORE	-	○ Ignore ○ Activate
Reflectance Option	ISEA	-	○ Ignore ○ Activate

OK Cancel

Figure A-23. FASCAT Run and Output Options Screen

The Background Component screen is shown in Figure A-24 and incorporates data from the ALBF card. Data from this card are required.

Background Component

Parameter	Code Variable	Units	User Values
Average Surface Reflectance	ALB	-	
Representative Wavelength	LAMDA	µm	
Base Altitude of Top Layer	BAT	km	

OK Cancel

Figure A-24. FASCAT Background Component Screen

The Location, Date and Time screen is shown in Figure A-25 and incorporates data from the ZENF, DAYF and THTF cards. The user must specify whether to specify Solar Zenith Angle or Local Time. The screen changes accordingly. Data on this screen are required.

Location, Date and Time

Parameter	Code Variable	Units	User Values
Julian Date	JULIAN	-	
Latitude	XLAT	degrees	
○ Specify Solar Zenith Angle ○ Specify Local Time	THETAS	degrees	

OK Cancel

Figure A-25. FASCAT Location, Date and Time Screen

The Extraterrestrial Solar Irradiance screen is shown in Figure A-26 and incorporates data from the FACF card. Data on this screen are required.

Extraterrestrial Solar Irradiance

Parameter	Code Variable	Units	User Values
Extraterrestrial Solar Irradiance	FAC	μ/cm^2mm	

OK Cancel

Figure A-26. FASCAT Extraterrestrial Solar Irradiance Screen

The Azimuth Viewing Angles and Zenith Viewing Angles screens are shown in Figures A-27 and A-28. These screen correspond to the NPHF, PHIF, NTHF and THF1 cards. The user can choose to use the defaults or specify the data. Data from these screens are required.

Azimuth Viewing Angles

Parameter	Code Variable	Units	User Values
Azimuth Viewing Angles	PHINT(1)	degrees	0
	PHINT(2)	degrees	90
	PHINT(3)	degrees	180

OK | Cancel

Figure A-27. FASCAT Azimuth Viewing Angles Screen

FASCAT Zenith Viewing Angles

○ Specify Values ○ Use Default Values

Parameter	Code Variable	Units
Zenith Viewing Angles	THETA(J)	degrees

J	User Values	J	User Values
1	5	11	100
2	15	12	105
3	25	13	110
4	35	14	115
5	45	15	125
6	55	16	135
7	65	17	145
8	75	18	155
9	85	19	165
10	95	20	175

Display Defaults | Clear Values | OK | Cancel

Figure A-28. FASCAT Zenith Viewing Angles Screen

The Optical Profiles screen incorporate data from the NLYF, ISPF, ZLDFF, INDF, and the TDEF cards. Because the Aerosol Type of Atmospheric layer parameter dictates what other parameters are needed, the inputs on this screen change based on this choice. These variations are shown in Figures A-29 - A-33. Figure A-31 is displayed when the Aerosol type of Atmospheric Layer parameter is either 31, 32, 33 or 34 (Enter Phase Function Calculation). From this screen the user can the bring the Beta Angle and Phase Function screen to specify such data. This screen is shown in Figure A-34. From this screen, the user can add a Beta Angle and Phase Function pair one at a time or specify on the previous screen the number to be of Beta Angle and Phase Functions to be specified. If the user adds combinations from this screen the result will be reflected on the previous screen. Figure A-33 is displayed when the Aerosol Type of Atmospheric Layer parameter is 5 (Use LOWTRN models). From this screen the user chooses which LOWTRN model to use.

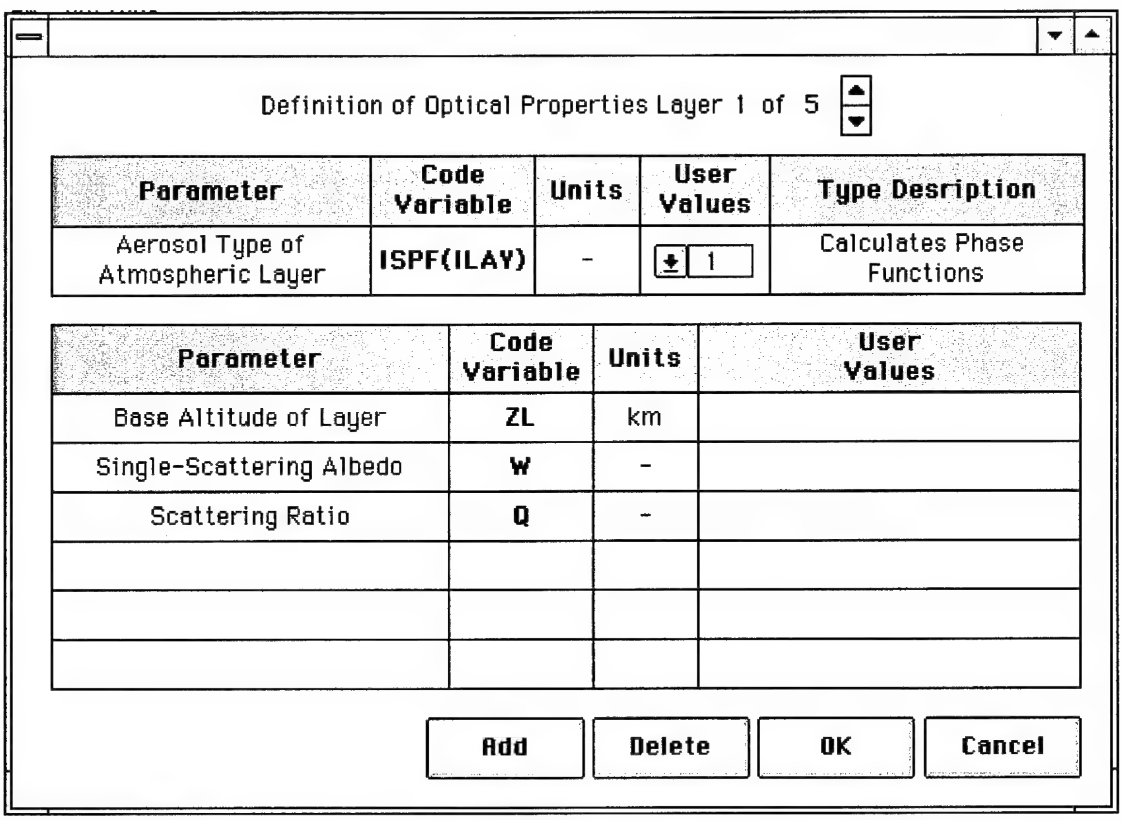


Figure A-29. FASCAT Definition of Optical Properties, Option 1

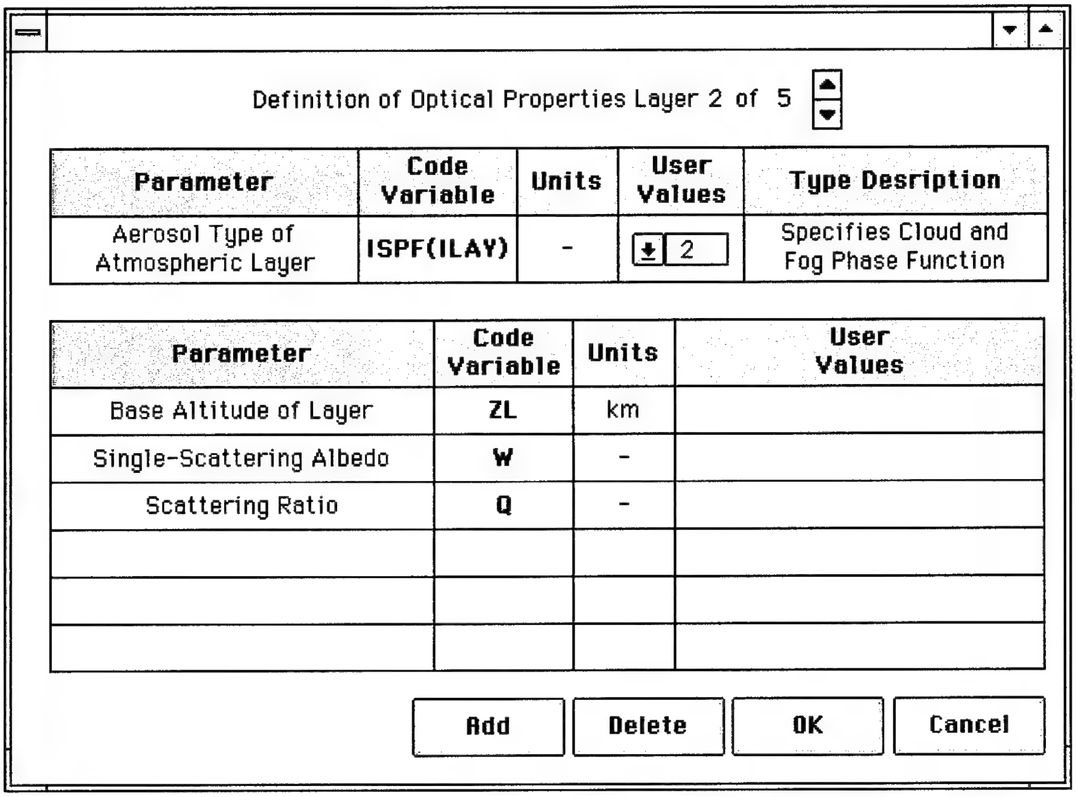


Figure A-30. FASCAT Definition of Optical Properties, Option 2

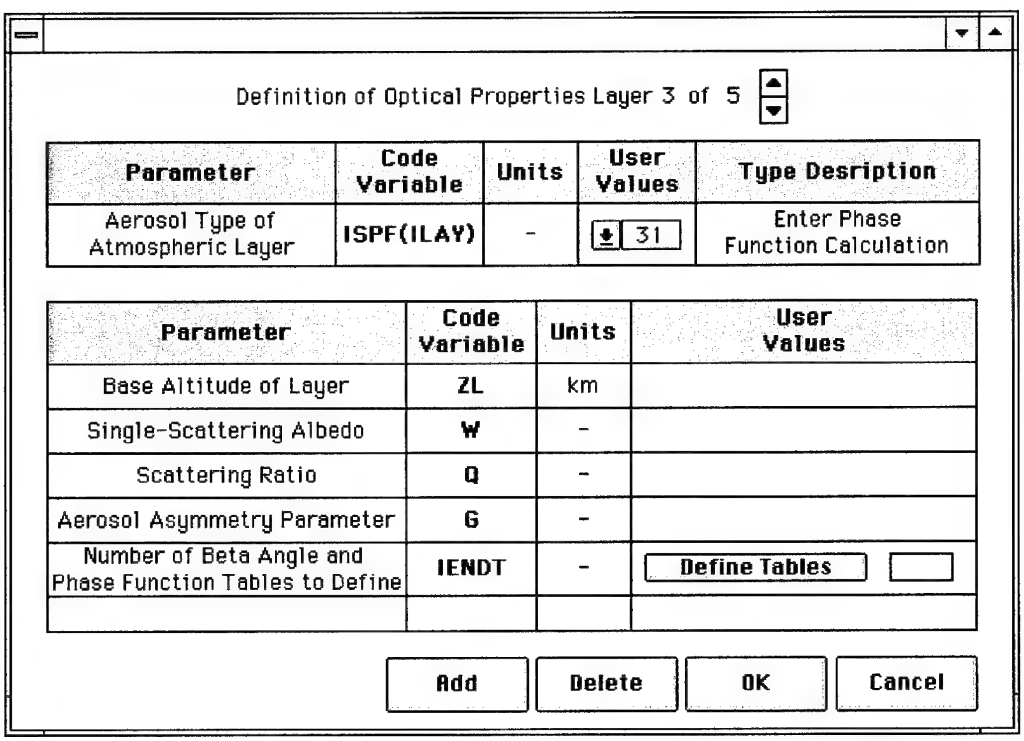
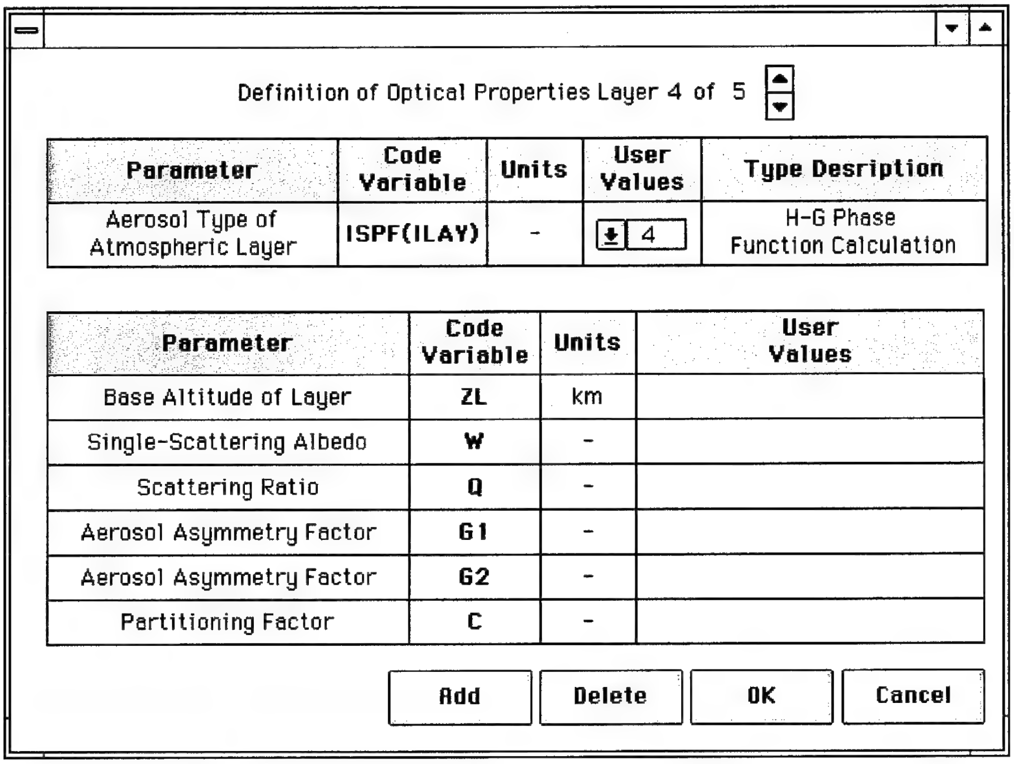


Figure A-31. FASCAT Definition of Optical Properties, Option 3



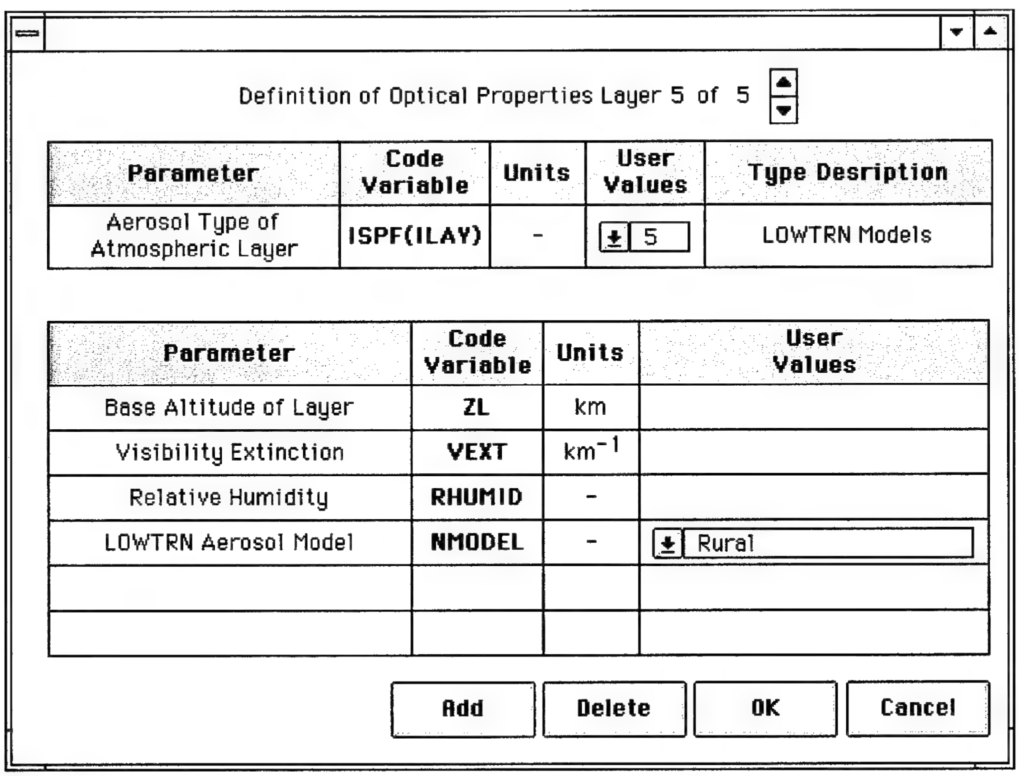
Definition of Optical Properties Layer 4 of 5

Parameter	Code Variable	Units	User Values	Type Desription
Aerosol Type of Atmospheric Layer	ISPF(ILAY)	-	4	H-G Phase Function Calculation

Parameter	Code Variable	Units	User Values
Base Altitude of Layer	ZL	km	
Single-Scattering Albedo	W	-	
Scattering Ratio	Q	-	
Aerosol Asymmetry Factor	G1	-	
Aerosol Asymmetry Factor	G2	-	
Partitioning Factor	C	-	

Add Delete OK Cancel

Figure A-32. FASCAT Definition of Optical Properties, Option 4



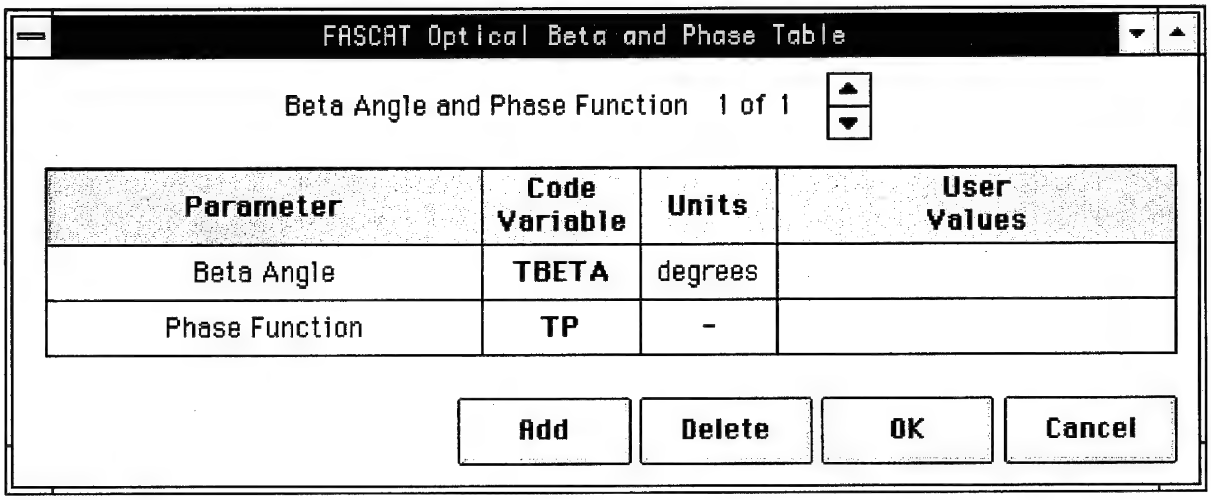
Definition of Optical Properties Layer 5 of 5

Parameter	Code Variable	Units	User Values	Type Desription
Aerosol Type of Atmospheric Layer	ISPF(ILAY)	-	5	LOWTRN Models

Parameter	Code Variable	Units	User Values
Base Altitude of Layer	ZL	km	
Visibility Extinction	VEXT	km^{-1}	
Relative Humidity	RHUMID	-	
LOWTRN Aerosol Model	NMODEL	-	Rural

Add Delete OK Cancel

Figure A-33. Definition of Optical Properties, Option 5


FASCAT Optical Beta and Phase Table

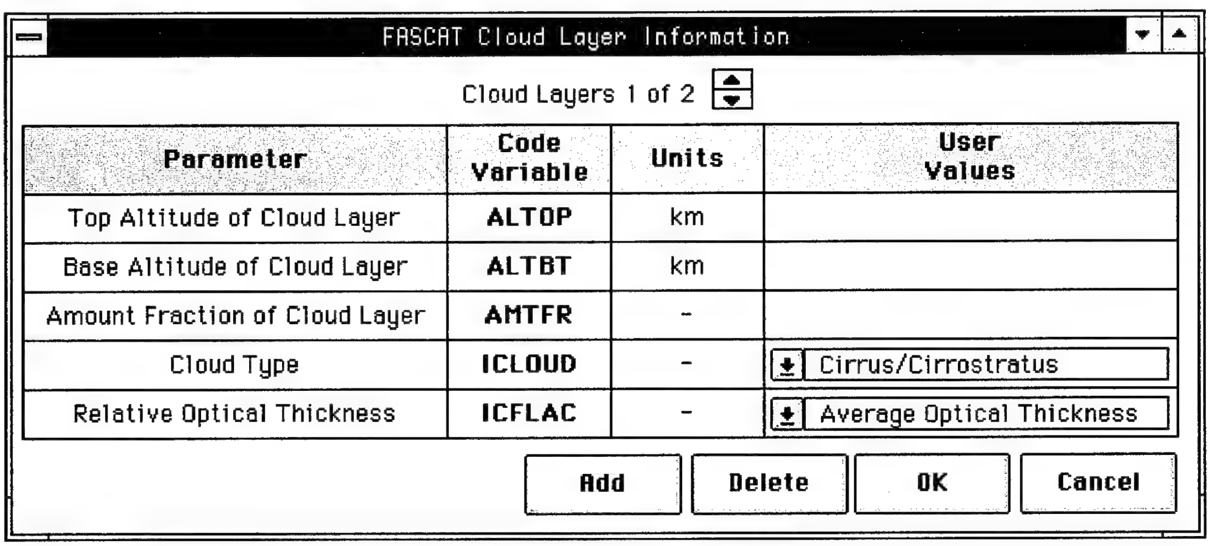
Beta Angle and Phase Function 1 of 1

Parameter	Code Variable	Units	User Values
Beta Angle	TBETA	degrees	
Phase Function	TP	-	

Add Delete OK Cancel

Figure A-34. FASCAT Beta Angle and Phase Function Screen

The Cloud Layer Information screen incorporates the cards NCLF, and ALTF and is shown in Figure A-35. This screen can be repeated as needed. The user can add a new screen by choosing the Add button. The user can move to the next or previous screens by using the arrows at the top of the screen. The user can delete the current screen by choosing the Delete button. The number of Cloud Layer Information screens is shown by the top line of each screen.


FASCAT Cloud Layer Information

Cloud Layers 1 of 2

Parameter	Code Variable	Units	User Values
Top Altitude of Cloud Layer	ALTOP	km	
Base Altitude of Cloud Layer	ALTBT	km	
Amount Fraction of Cloud Layer	AMTFR	-	
Cloud Type	ICLOUD	-	Cirrus/Cirrostratus
Relative Optical Thickness	ICFLAC	-	Average Optical Thickness

Add Delete OK Cancel

Figure A-35. FASCAT Cloud Layer Information Screen

The Target-Observer Combination screen, shown in Figure A-36, incorporates the NDLF, DSN1 and DSN2 cards. The user can add additional screens by clicking the Add button and can delete the current screen by clicking the Delete button. The user can cycle through the screens by using the arrows at the top of the screen.

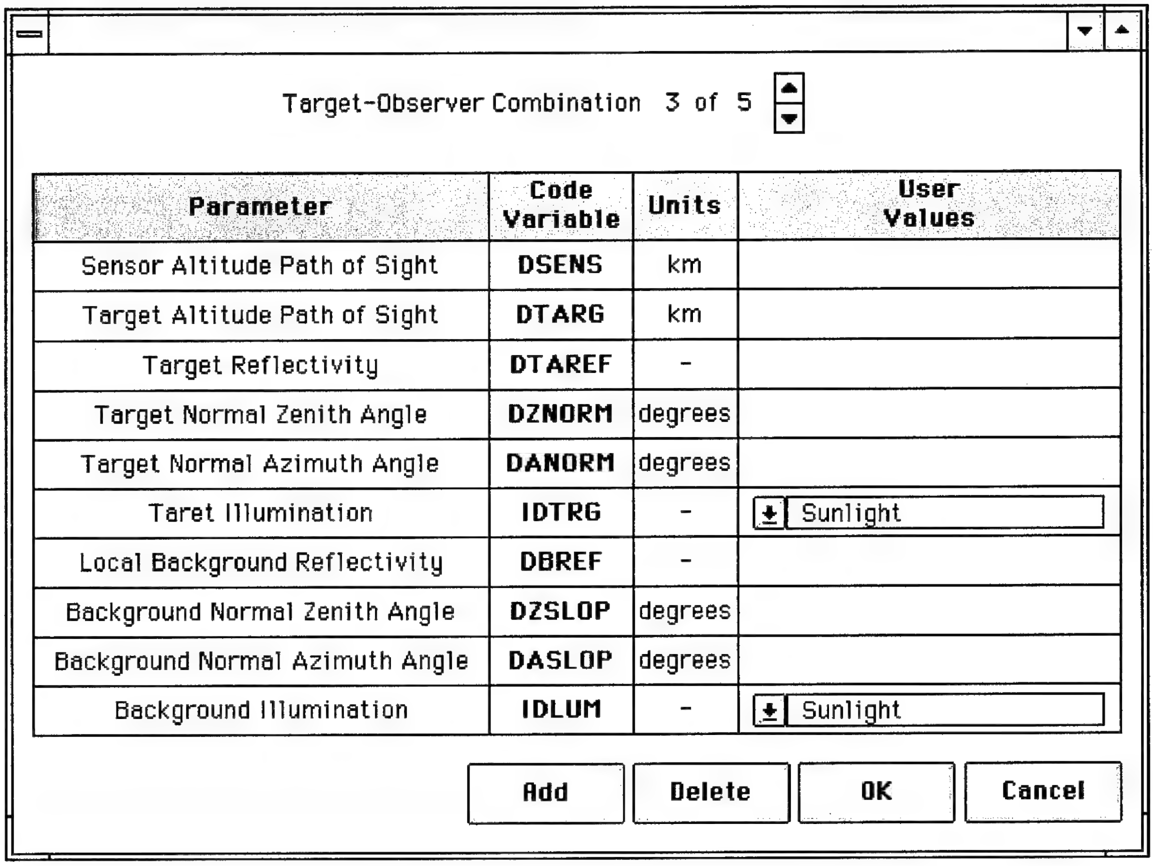


Figure A-36. FASCAT Target-Observer Combination Screen

The Upward Path of Sight screen is shown in Figure A-37 and incorporates the NULF and USN1 cards. The user can add additional screens by clicking the Add button and can delete the current screen by clicking the Delete button. The user can cycle through the screens by using the arrows at the top of the screen.

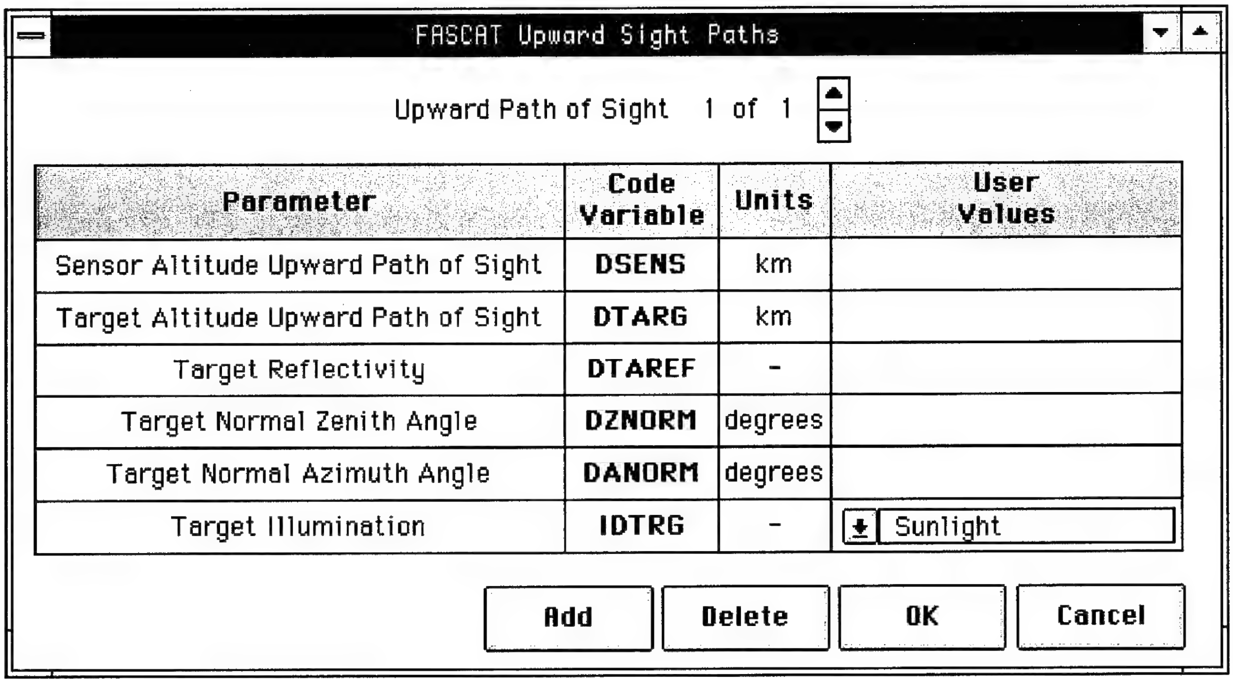


Figure A-37. FASCAT Upward Path of Sight Screen

A.5 Fire Induced Transmittance and Turbulence Effects (FITTE) Module

The Fire Induced Transmittance and Turbulence Effects (FITTE) module predicts transmittance through fire plumes path radiance from fire plumes and, optionally, effects of fire plume turbulence on laser propagation for a given line of sight. The user can specify data for multiple runs. FITTE can use data from CLIMAT if indicated to do so on the Meteorological screen. Figure A-38 shows the Input Menu Choices.

FITTE

Input Menu
Reference → Laser
→ Imager
→ Target
Fire Location
Optical
Waveband
Time-Series Calculation Control
Molecular Effects Calculation Control
Meteorological
Line of Sight

Figure A-38. FITTE Input Menu Choices

The Reference screen, shown in Figure A-39 incorporates data found on the REFD card. These data are required. Based on the Scenario Type specified, the user must specify additional inputs by choosing the buttons at the bottom of the screen. The choices are Laser Data, Imager Parameters, and Target Data for Thermal Emission Calculations and are shown in Figures A-40 - A-42. They incorporate data found on the following cards, DETD, SCN3 and TARG. When an option is invalid the corresponding button will become inactive, and the text will be grayed out.

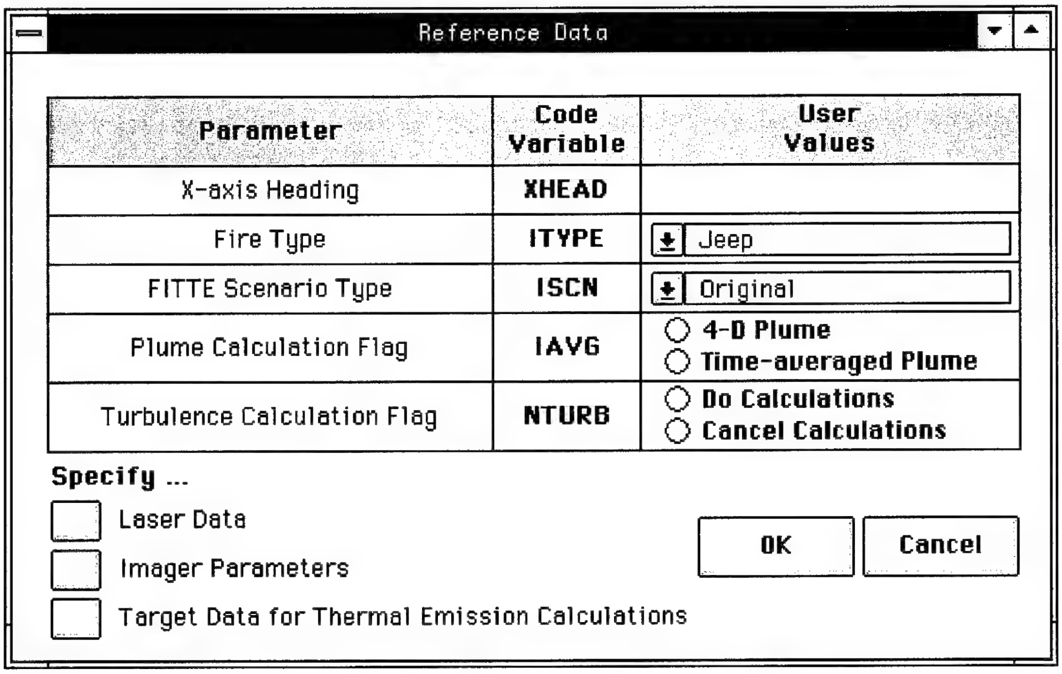


Figure A-39. FITTE Reference Screen

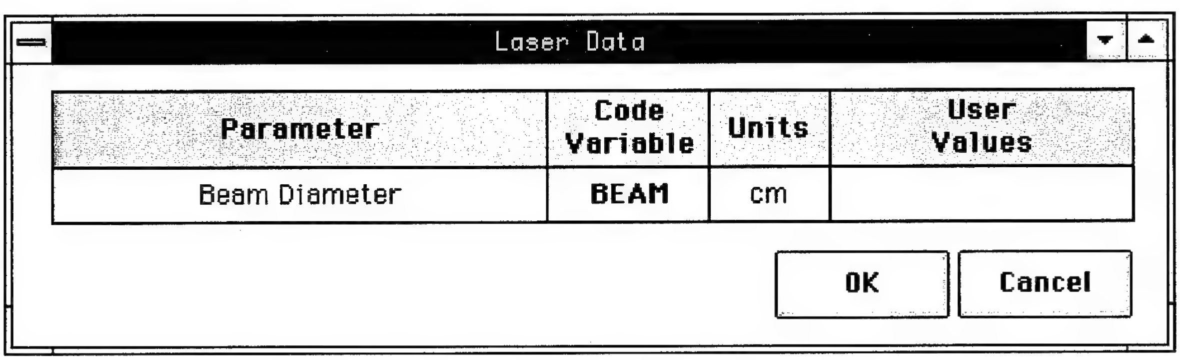


Figure A-40. FITTE Laser Data Screen

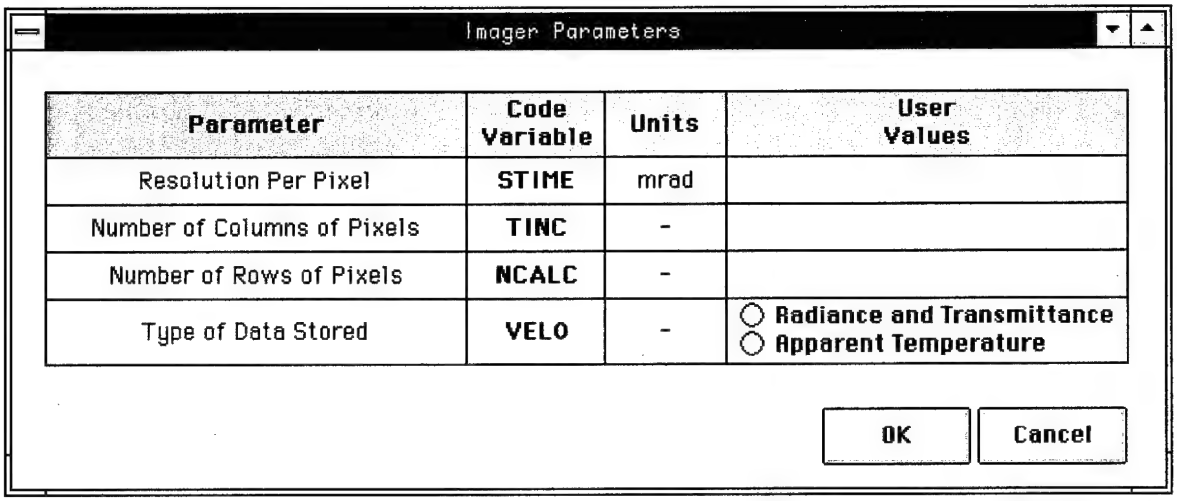


Figure A-41. FITTE Image Parameters Screen

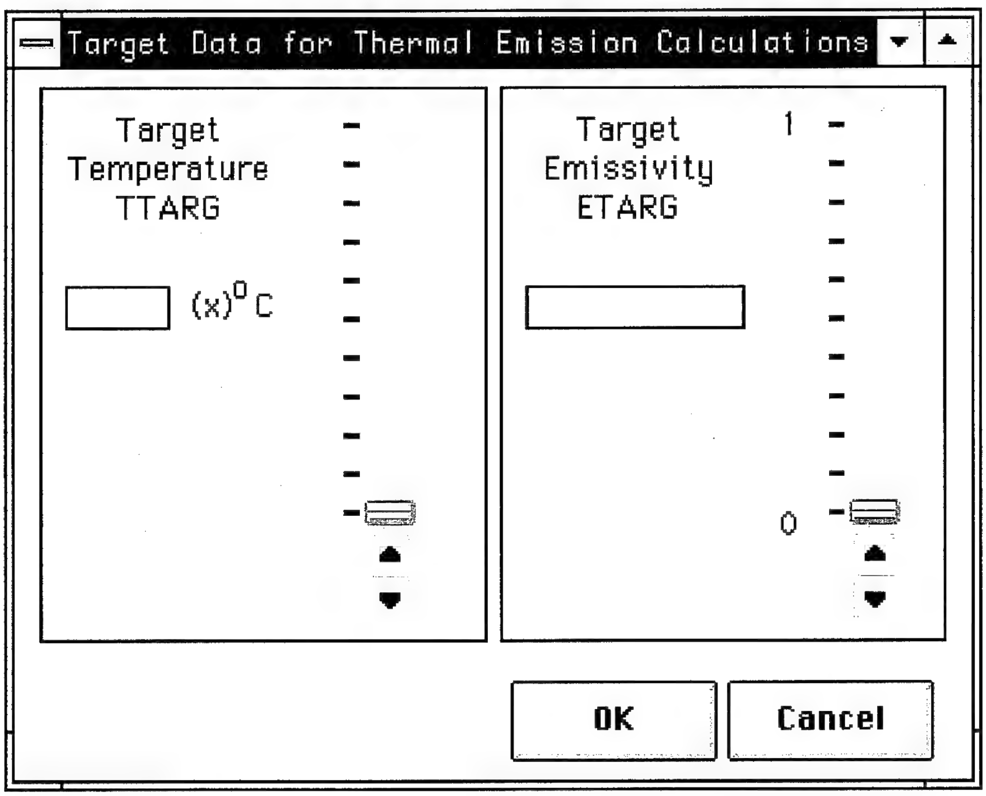


Figure A-42. FITTE Target Data Screen

The Fire Location Data screen, shown in Figure A-43 incorporates data found on the SCRL card. Data on this card are required.

Fire Location Data

Parameter		Code Variable	Units	Values
Center of Fire	X	**US(1)**	m	
	Y	**US(2)**	m	
Base of Fire	Z	**US(3)**	m	

OK **Cancel**

Figure A-43. FITTE Fire Location Data Screen

The Waveband Calculation Control screen, shown in Figure A-44 incorporates data found on the BAND card. Data on this card are not required.

Waveband Calculation Control

Parameter	Code Variable	Units	User Values
Waveband Calculation Flag	**XHEAD**	-	○ **Single Wavelength** ○ **Perform Waveband**
Beginning Wavenumber of Band	**ITYPE**	cm^{-1}	
Ending Wavenumber of Band	**ISCN**	cm^{-1}	
Number of Intervals in Band	**IAVG**	-	
Instrument Response Function Over Waveband	**NTURB**	-	○ **Rectangular** ○ **Triangular** ○ **Trapezoidal**
Printing of Spectrally Resolved Values Flag	**NTURB**	-	○ **Do Not Print** ○ **Print**

OK **Cancel**

Figure A-44. FITTE Waveband Calculation Control Screen

The Optional Parameters for Calculation Control screen, shown in Figure A-45 incorporates data found on the OPT1 card. Data on this card are not required.

Optional Parameters for Calculation Control

Parameter	Code Variable	User Values
Fractional Change in Temperature	TCRITA	0.10
Number of Calculation Steps Throuhgh the Plume	NUMINT	30
Number of Path Segments for Calculation from Plume to Observer	NUMSEG	1

OK Cancel

Figure A-45. FITTE Optional Parameters for Calculation Control Screen

The Time-Series Calculation Control screen, shown in Figure A-46 incorporates data found on the TCAL card. Data on this card are not required.

Time-series Calculation Control

Parameter	Code Variable	Units	User Values
Start Time	STIME	s	100
Time Increment	TINC	s	1
Number of Calculations	NCALC	-	1
Velocity of Observer Toward Target along Line of Sight	VELO	m/s	0

OK Cancel

Figure A-46. FITTE Time-Series Calculation Control Screen

The Variation of Fire Parameters screen, shown in Figure A-47 incorporates data found on the SVAR card. Data on this card are not required.

Variation of Fire Parameters

Parameter	Code Variable	Units	User Values
Fire Mean Temperature	TEMPIN	Kelvin	97316
Fractional Multiplier of Aerosol Efficiency Factor	EFFAC	-	1
Radius of Fire	RADIN	m	
Burn Time	BTIME	s	1500

OK Cancel

Figure A-47. FITTE Variation of Fire Parameters Screen

The Molecular Effects Calculation Control screen, shown in Figure A-48 incorporates data found on the MOLS card.

Molecular Effects Calculation Control

Parameter	Code Variable	User Values
Molecular Transmittance Calculation Flag	IMOL	○ Omit Calculations ○ Include Calculations
Outside Plume Calculation Flag	IATM	○ Omit Calculations ○ Include Calculations

OK Cancel

Figure A-48. FITTE Molecular Effects Calculation Control Screen

The Meteorological screen, shown in Figure A-49 incorporates data found on the METD card. These data are required and the user must specify to use CLIMAT data or specify the data. If the user chooses to use CLIMAT data, amicable parameters will become inactive.

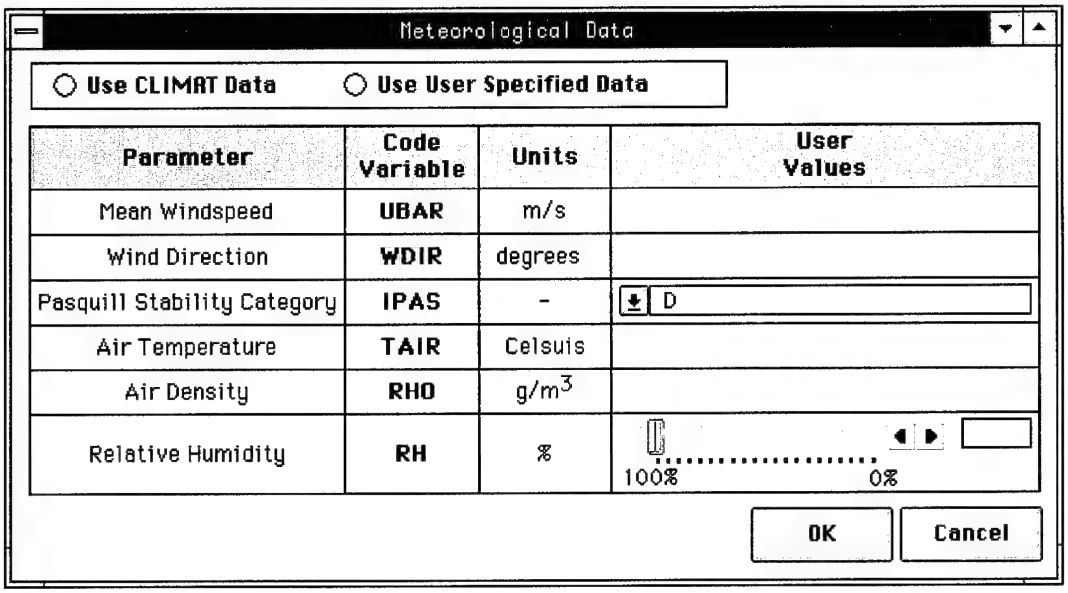


Figure A-49. FITTE Meteorological Screen

The Line of Sight Data screen, shown in Figure A-50 incorporates data found on the SCEN card. Data on this screen are required. These coordinates could also be specified using the point and click method utilized in the COMBIC GUI for observers and target positions. An example its described in the COMBIC Module Prototype Development section, Section 3.6. This implementation decision will be determined in Phase II.

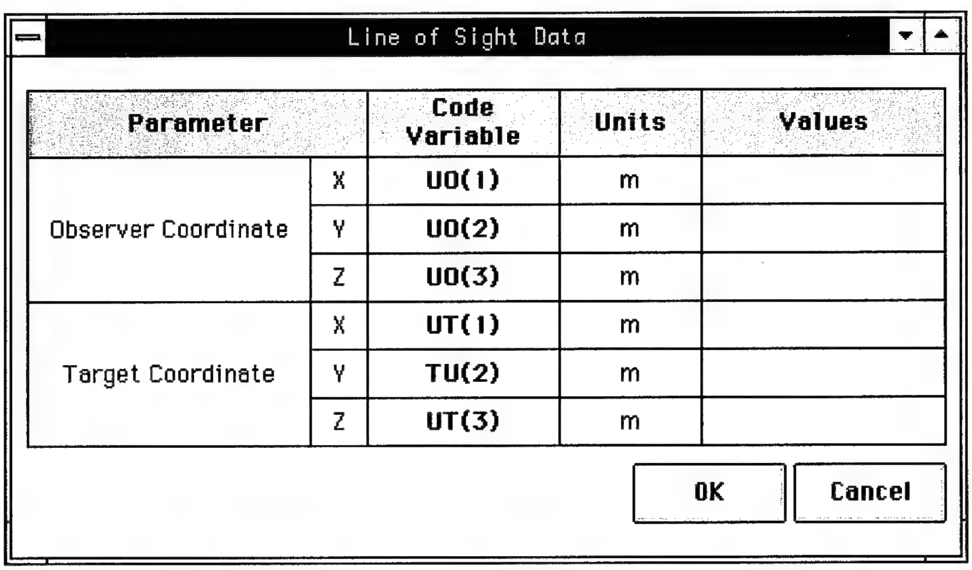


Figure A-50. FITTE Line of Sight Data Screen

A.6 Self-Screening Applications (GRNADE) Module

The Self-Screening Applications (GRNADE) module models the transmission through smoke screens produced by multiple round salvos of tub-launched L8A1 and M76 self-screening grenades. Under the card system, multiple runs was not supported. This option can be added and will be an implementation decision made in phase II. GRNADE can optionally use CLIMAT to produce the climatology data. Figure A-51 shows the Input Menu Choices. These GRNADE input screens are Title, Scenario Control Data Launcher and Salvo Data, Threat Data, Meteorological Data, Stability Data, Munition and Launcher Characteristics, Auxiliary Data, Mass Extinction Coefficients and Source Data.

GRANDE

Input Menu
Title
Scenario Control Data
Launcher and Salvo Data
Threat Data
Meteorological Data
Stability Data
Munition and Launcher Characteristics
Auxiliary Data
Mass Extinction Coefficients
Source Data

Figure A-51. GRNADE Input Menu Choices

The Title screen, shown in Figure A-52, incorporates data found on the HOLL card. Data on this card are not required.

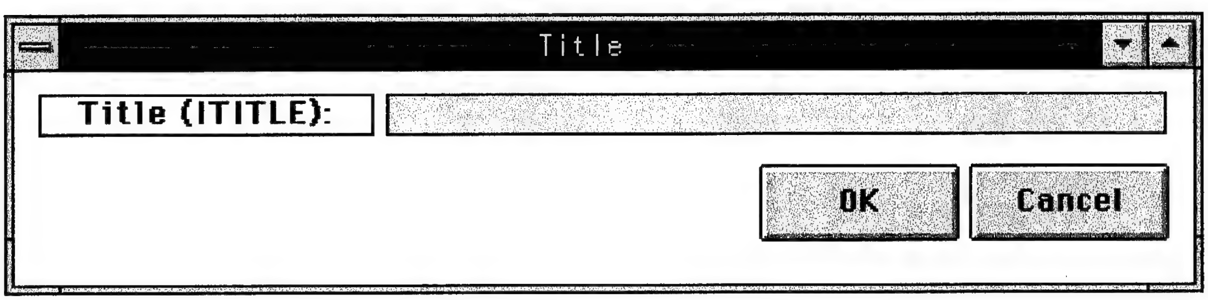


Figure A-52. GRNADE Title Screen

The Scenario Control Data screen, shown in Figure A-53, incorporates data found on the CNTR card. Data on this card are required.

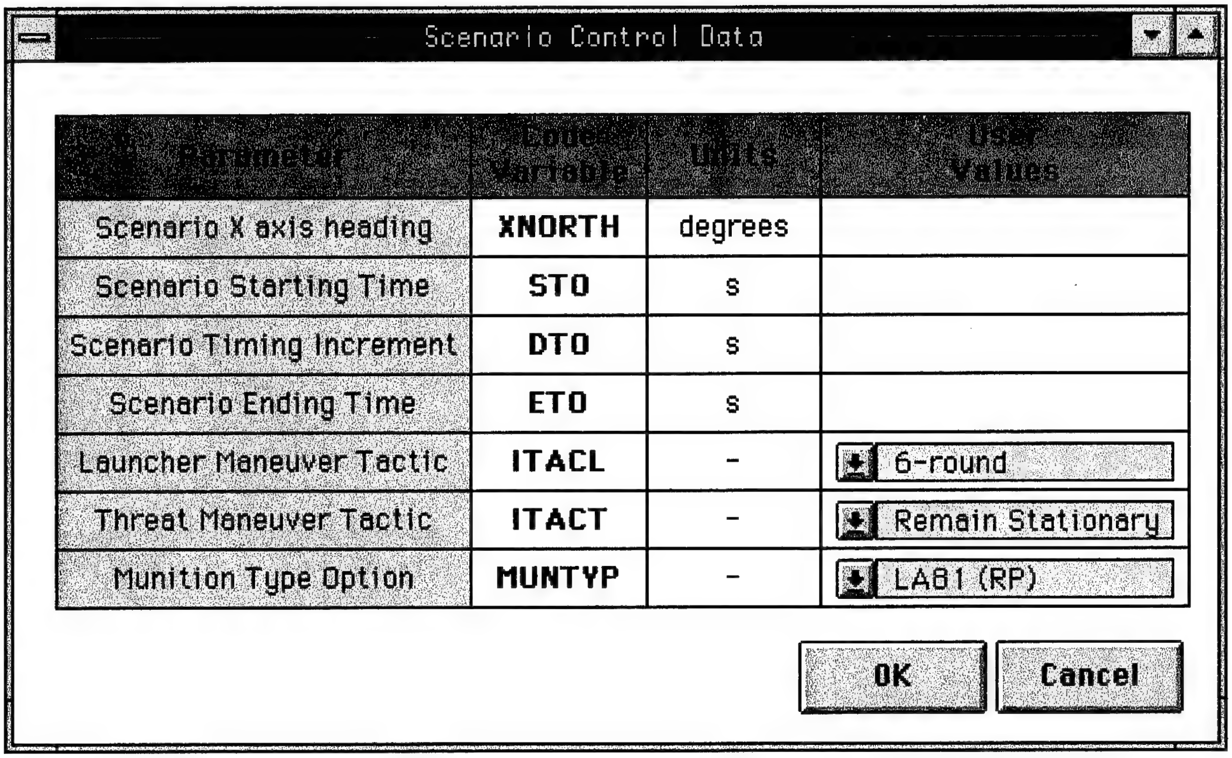


Figure A-53. GRNADE Scenario Control Data Screen

The Launcher and Salvo Data screen, shown in Figure A-54, incorporates data found on the LAUN card and launcher data from the OPT1 card. Data on this card are required.

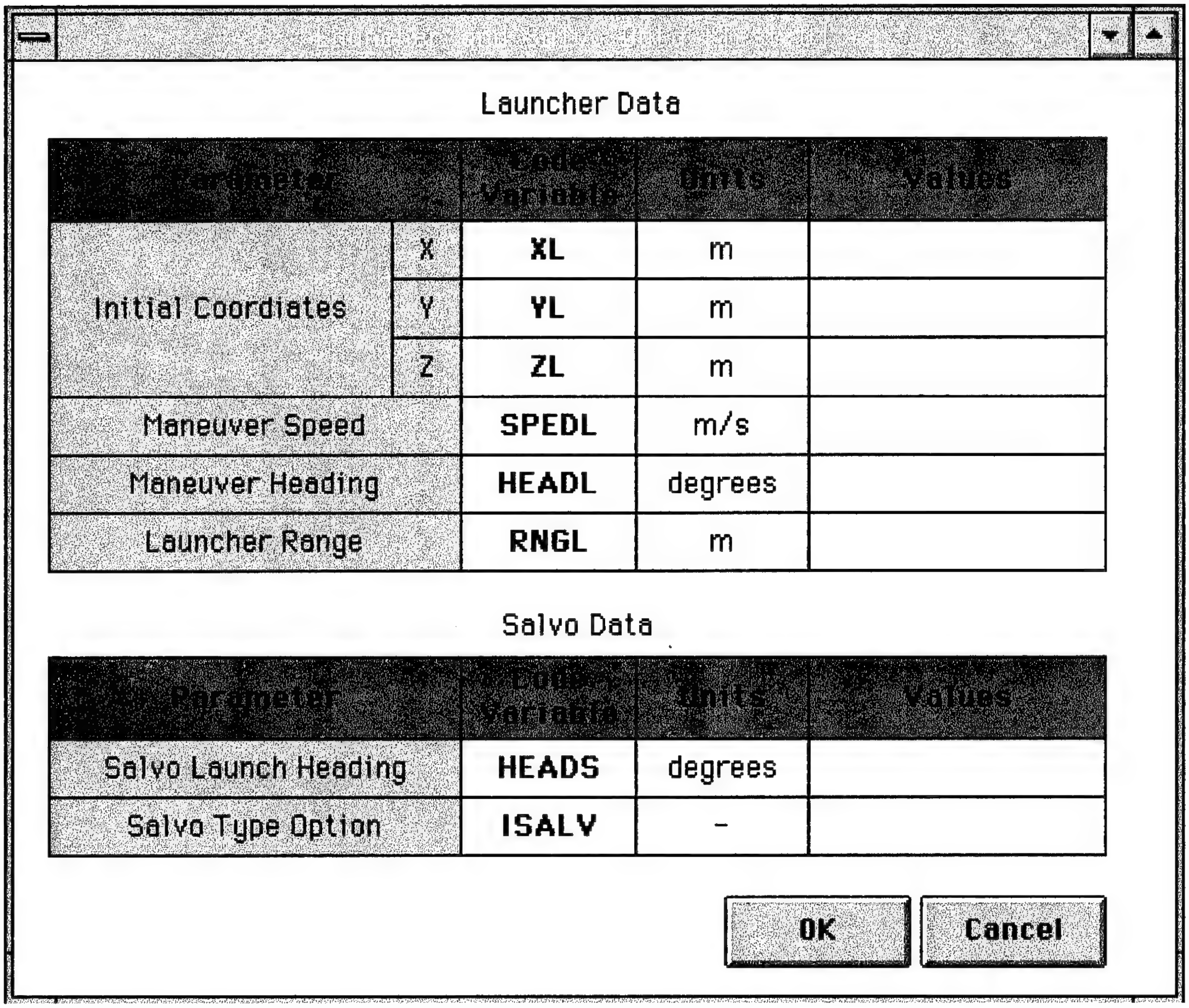


Figure A-54. GRNADE Launcher and Salvo Data Screen

The Threat screen, shown in Figure A-55, incorporates data found on the THRT card. Data on this card are required.

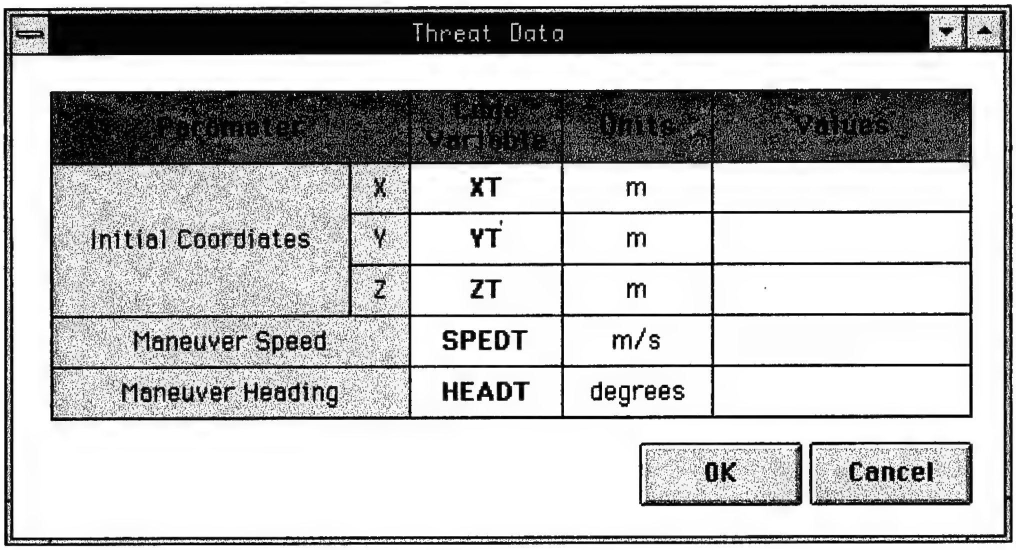


Figure A-55. GRNADE Threat Screen

The Meteorological screen, shown in Figure 56, incorporates data found on the METR card. These data are required and the user must choose to use CLIMAT data, which inactivates all parameters, or choose to specify the data.

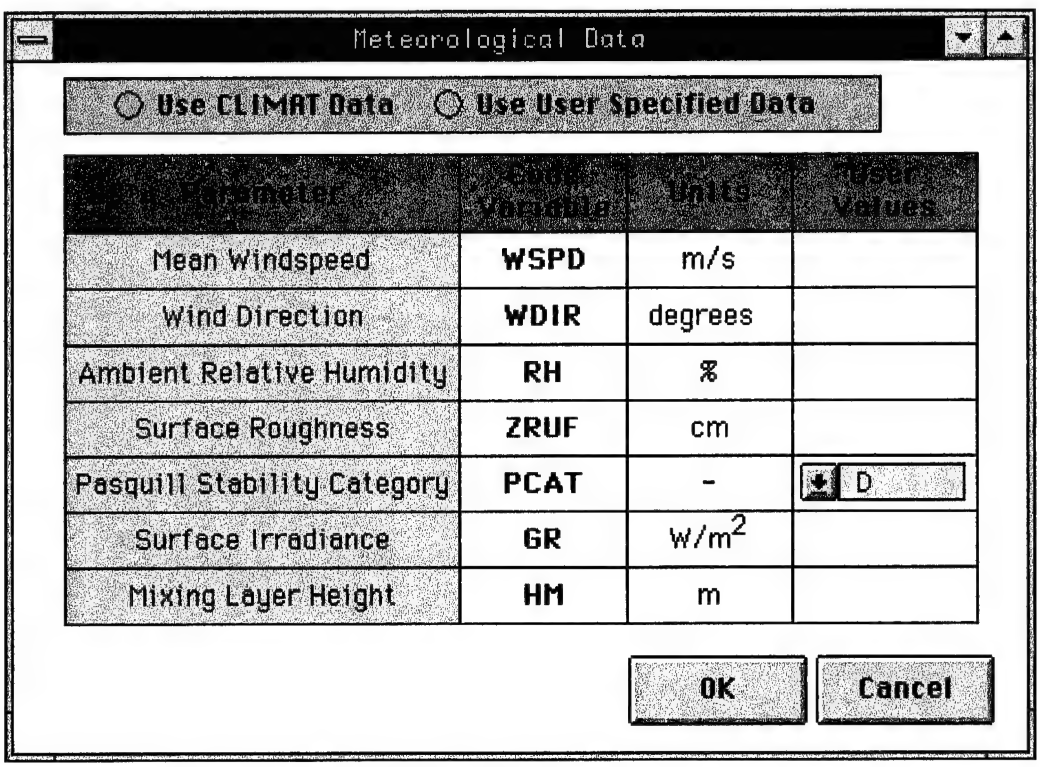


Figure A-56. GRNADE Meteorological Screen

The Stability screen, shown in Figure A-57, incorporates data found on the STBL card. Data on this card are required.

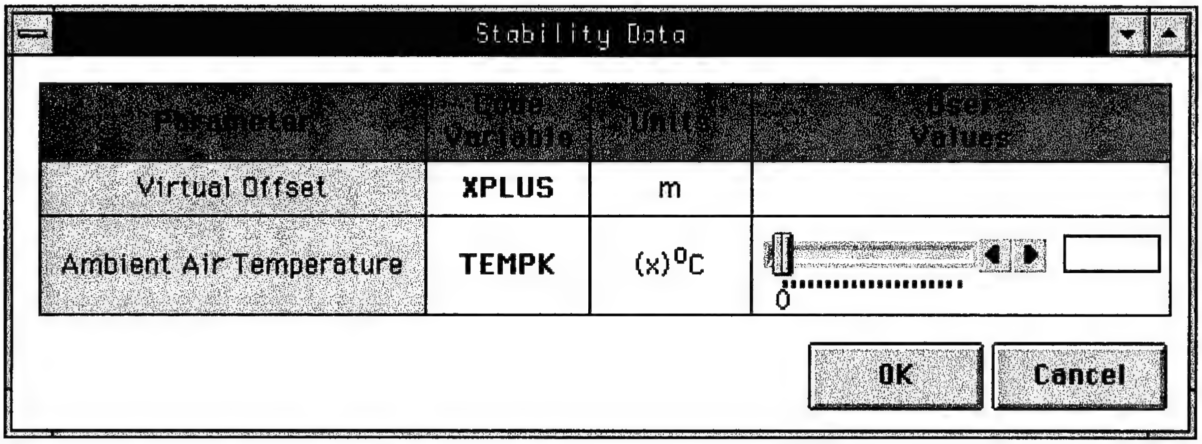


Figure A-57. GRNADE Stability Screen

The Munition Data screen, shown in Figure A-58, incorporates data found on the OPT1 card. Data on this card are not required.

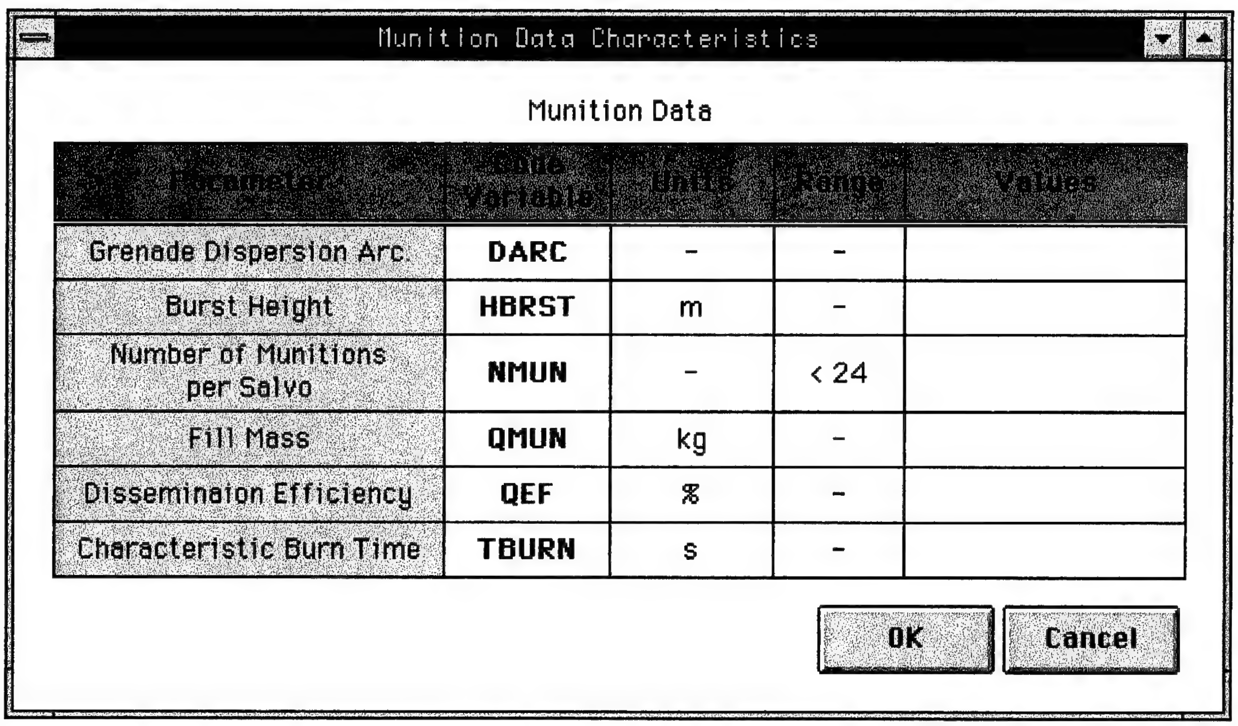


Figure A-58. GRNADE Munition Data Screen

The Auxiliary Target screen, shown in Figure A-59, incorporates data found on the OPT2 card. Data on this card are not required.

Auxiliary Data

Parameter		Code Variable	Units	Values
Coordinates	X	XA	m	
	Y	YA	m	
	Z	ZA	m	
Maneuver Speed		SPEDA	m/s	
Maneuver Heading		HEADA	-	

OK Cancel

Figure A-59. GRNADE Auxiliary Target Screen

The Mass Extinction Coefficients screen, shown in Figure A-60, incorporates data found on the OPT3 card. Data on this card are not required.

Mass Extinction Coefficients

Parameter	Code Variable	Units	Values
Band 1	EXTC(1)	m/s	
Band 2	EXTC(2)	m/s	
Band 3	EXTC(3)	m/s	
Band 4	EXTC(4)	m/s	
Band 5	EXTC(5)	m/s	
Band 6	EXTC(6)	m/s	
Obscurant Mass Yeild Factor	EXTC(6)	m/s	1.0

OK Cancel

Figure A-60. GRNADE Mass Extinction Coefficients Screen

The Source screen, shown in Figure A-61, incorporates data found on the OPT4 card. Data on this card are not required.

Source Data

Parameter	Code Variable	Units	Values
Airburst to Smoke Curtian Mass Ratio	F	%	
Subclouds Merge Time	TMRG	s	
Airburst Characteristic Growth Time	TNOT	s	
Maneuver Heading	SIGO	m	

OK Cancel

Figure A-61. GRNADE Source Screen

A.7 ILUMA

The Natural Illumination Under Realistic Weather Conditions (ILUMA) module predicts natural illumination under realistic atmospheric conditions. The option will be present for the user to specify data for multiple runs. Figure A-62 shows the Input Menu Choices. ILUMA input screens are the Location, Date and Time, Single Layer Option, an Three Layer Option Screens.

ILUMA

Input Menu
Location Date and Time
Single Layer Option
Three Layer Option

Figure A-62. ILUMA Input Menu Choices

The Location, Date and Time Screen, shown in Figure A-63, incorporates data found on the GEOS and DATE cards. All data on this screen are required.

Specify Location

Parameter	Code Variable	Units	Typical Values	User Values
Local Latitude	SLAT	(x)°	-180.0 - +180.0	
Local Longitude	SLON	(x)°	-90.0 - +90.0	
Surface Albedo	RG	-	-	

Specify Date and Time

Parameter	Code Variable	User Values
Month	MONTH	January
Day	DAY	1
Greenwich Time	GTIME	
Year	YEAR	

OK Cancel

Figure A-63. ILUMA Location, Date and Time Screen

The Single Layer Option Screen, shown in Figure A-64, incorporates data found on the WEAX card. The Three Layer Option screen shown in Figure A-65, incorporates data found on the ALBD, CLFR, AND CLDS cards. Either the single or the three layer option must be chosen.

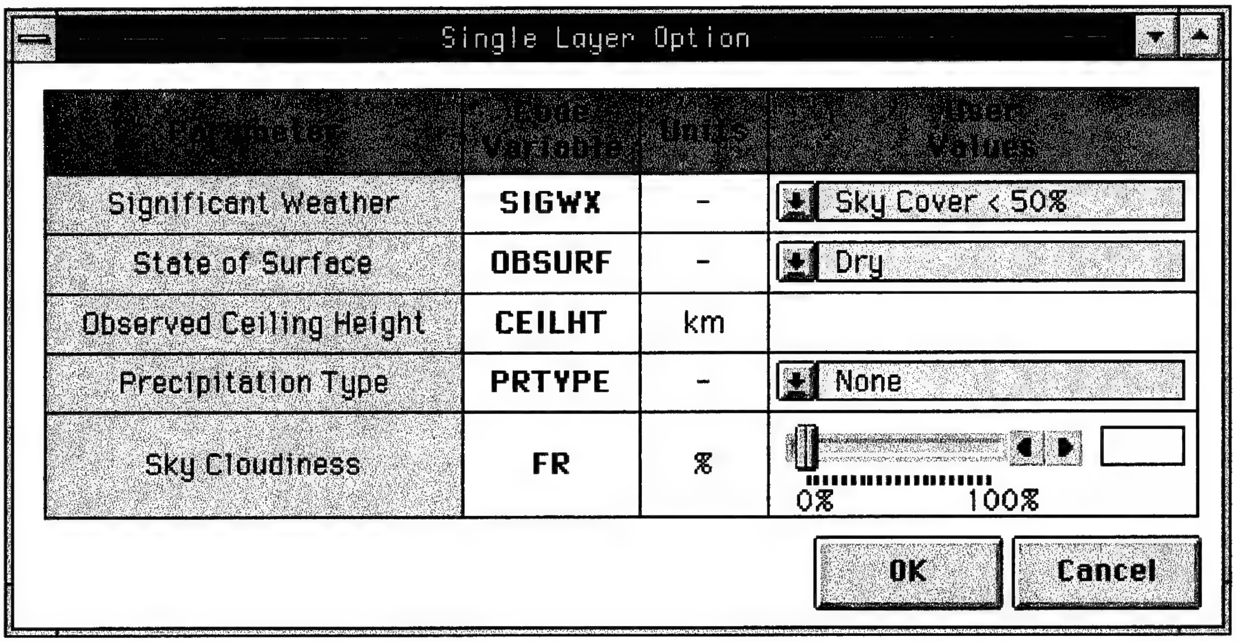


Figure A-64. ILUMA Single Layer Option Screen

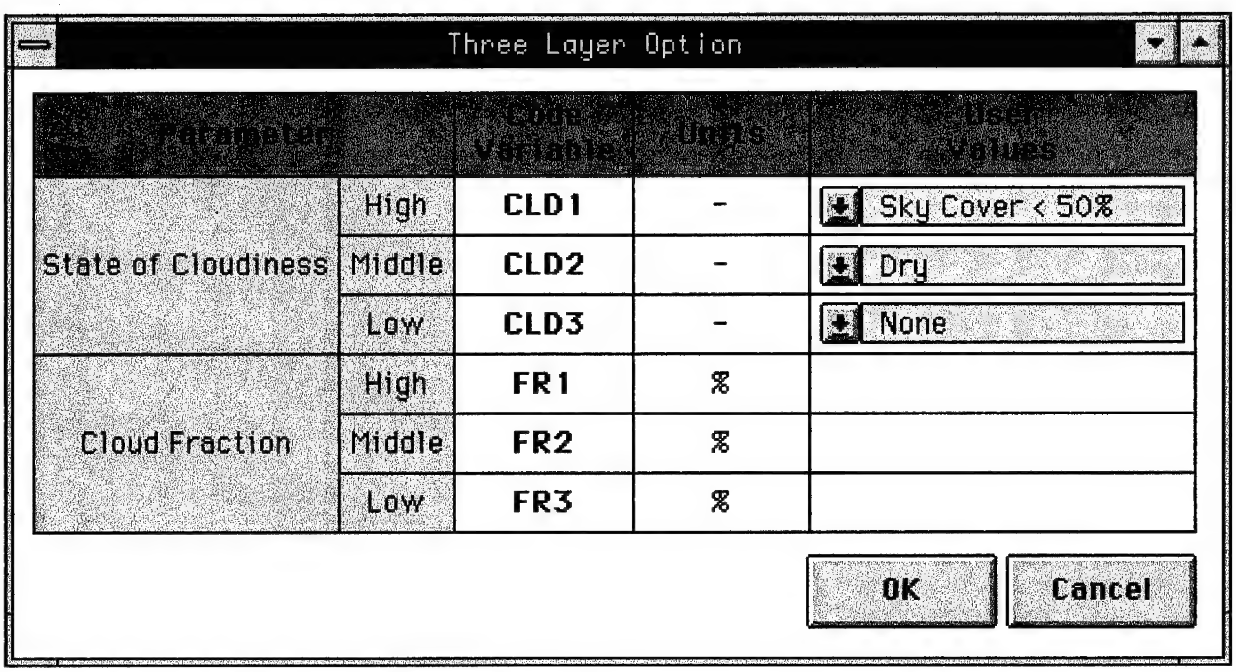


Figure A-65. ILUMA Three Layer Option Screen

A.8 Munition Expenditure (KWIK) Module

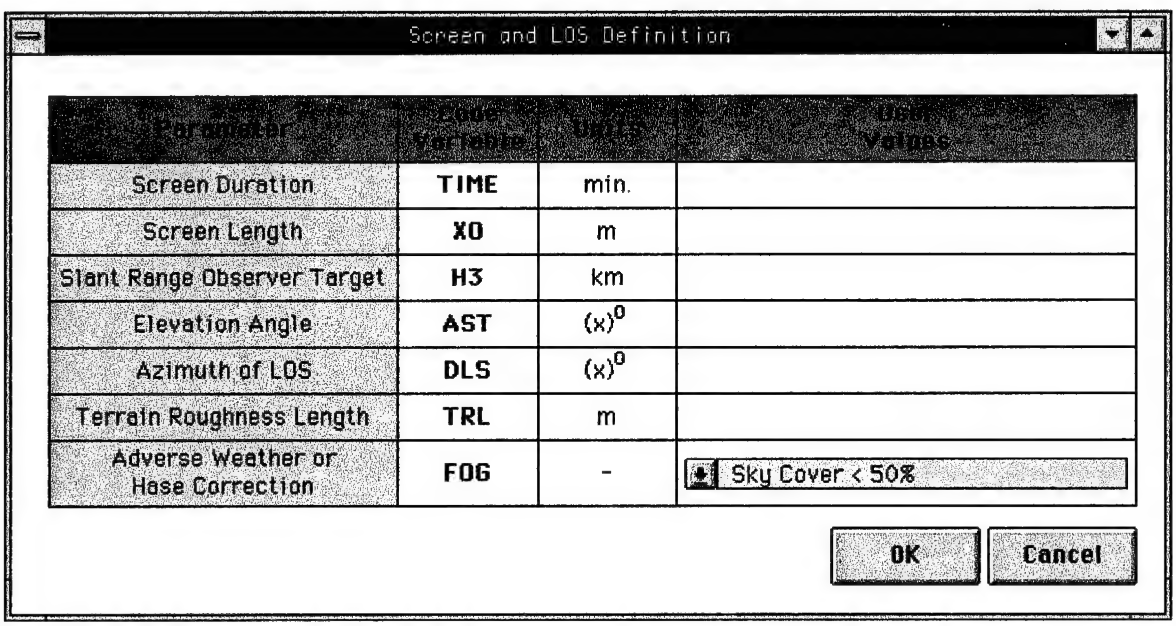
The Munition Expenditure (KWIK) module is a smoke munition expenditure algorithm that predicts the required number of white phosphorus or hexachloroethane howitzer and mortar smoke munitions necessary to reduce the probability of target detection to a given level. The multiple run option will be available. KWIK can optionally use CLIMAT data to specify climatology data. KWIK calls XSCALE during execution to determine the transmittance through natural aerosols. Figure A-66 shows the Input Menu Choices. Inputs are captured in four input screens: Screen and LOS Definition, Meteorological, Pasquill Stability Calculation and Munition Type.

KWIK

Input Menu
Screen and Line Sight
Munition Type
Meteorological Pasquile Stability Calculation
Julian Calculation
Time Calculation

Figure A-66. KWIK Input Menu Choices

The Screen and LOS Definition screen is shown in Figure A-67 and captures data found on the SCRN card.



Parameter	Code Variable	Units	User Values
Screen Duration	TIME	min.	
Screen Length	XO	m	
Slant Range Observer Target	H3	km	
Elevation Angle	AST	$(x)^0$	
Azimuth of LOS	DLS	$(x)^0$	
Terrain Roughness Length	TRL	m	
Adverse Weather or Hase Correction	FOG	-	Sky Cover < 50%

Figure A-67. KWIK Screen and LOS Definition Screen

The Meteorological Data screen captures data found on the METR card and is shown in Figure A-68. The user has the choice to use the CLIMAT data or specify the data. If the user chooses to use CLIMAT data all parameters will become inactive. This screen can invoke the Pasquill Category Calculation Screen at the users choice when the user specified data option is selected. This screen is shown in Figure A-69 and incorporates data from the PASQ card.

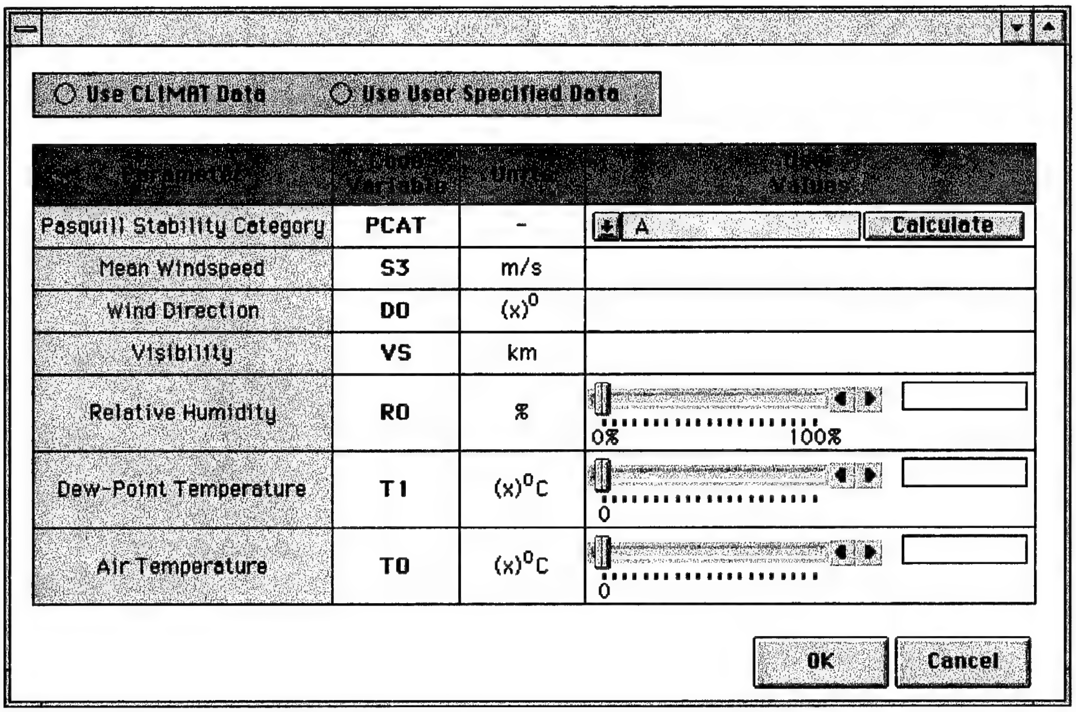


Figure A-68. KWIK Meteorological Data Screen

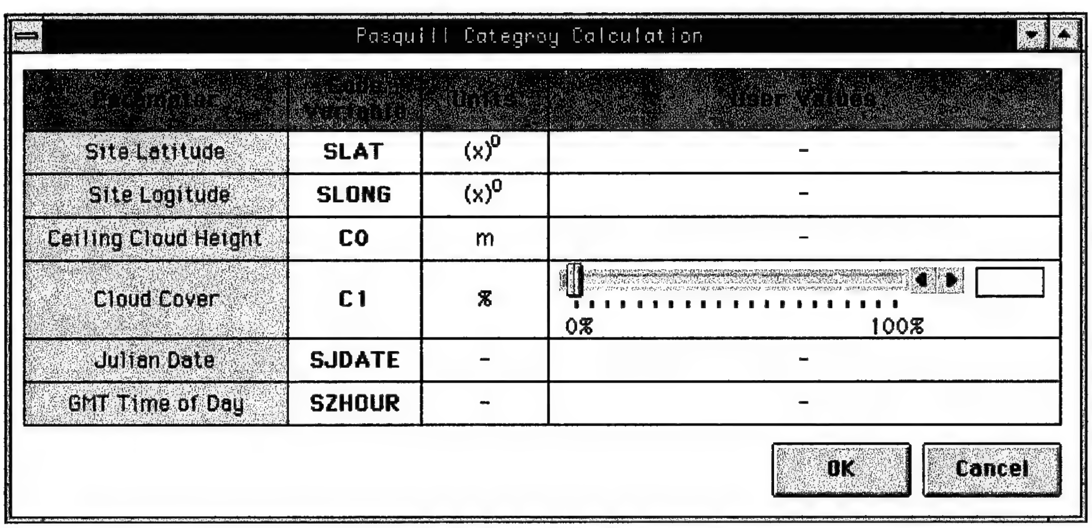


Figure A-69. KWIK Pasquill Category Calculation Screen

The Munition Type screen captures data found on the MUNI card and is shown in Figure A-70. Data on this screen are required.

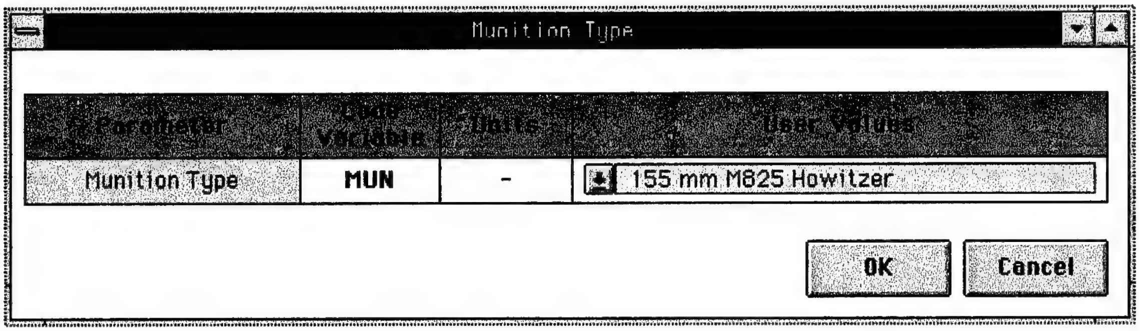


Figure A-70. KWIK Munition Type Screen

A.9 Large Area Screening Systems (LASS) Module

The Large Area Screening Systems (LASS) module provides a tool for the study of large area screening systems applications and effects. LASS documentation does not indicate interaction with other modules, nor does it indicate which cards are required. Lass is made up of two models: the Transport and Diffusion model and the Radiative Transfer model. Figure A-71 and A-72 show the Mode and Input Menu Choices for each model respectively. The user signifies which model to use from the Mode menu. The Input Menu choices change accordingly. Input for the Transport and Diffusion Model is captured in eight input screens: Line Of Sight (LOS) Definition, Source Data, Source Centerline Coordinates, Munition and Obscurant Data, Meteorological, Contour Map Parameters, Plot, Source Data, and Options. Input for the Radiative Transfer model is captured in four input screens: Obscurant Optical Properties, Solar and Sky Data, Target and Background Albedos, and Azimuth Calculations.

LASS

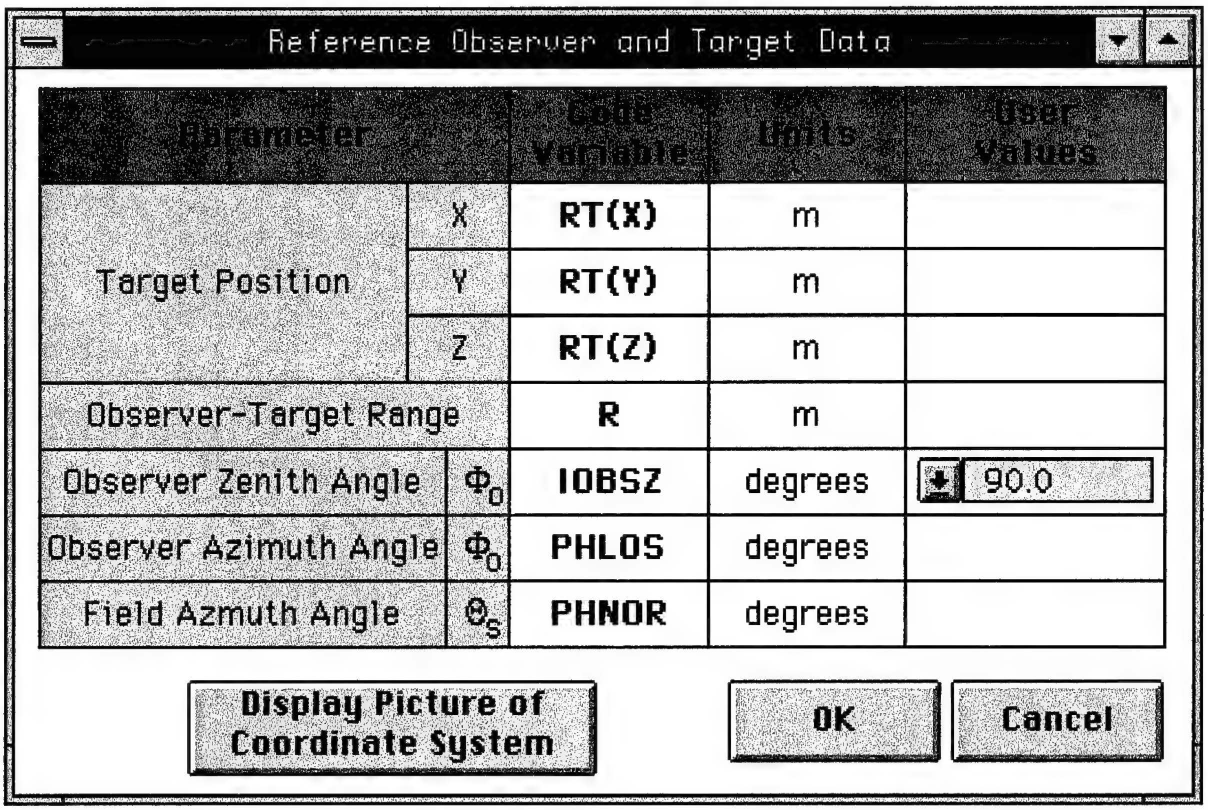
Mode Menu	**Input Menu**
Transport and Diffusion	**Line Sight Definition**
Radiative	**Source Centerline Coordinates**
	Munitions and Obscuration Data
	Meteorological Data
	Contour Map Parameters
	Plot
	Source Data
	Options

Figure A-71. LASS Mode and Input Menus Choices, Option 1

LASS	
<u>Mode Menu</u>	<u>Input Menu</u>
Transport and Diffusion	**Obscurant Optical Parameters**
Radiative	**Solar and Sky Data**
	Target and Background Albedos
	Azimuths Calculations

Figure A-72. LASS Mode and Input Menus Choices, Option 2

The Line Of Sight (LOS) Definition screen captures data found on the SCEN card and is shown in Figure A-73. From this screen the user can bring the Coordinate Picture Screen, shown in Figure A-74. This screen is a display sketch illustrating the relationship between a user coordinate system and the north-east system.


Reference Observer and Target Data

Parameter		Code Variable	Units	User Values
Target Position	X	RT(X)	m	
	Y	RT(Y)	m	
	Z	RT(Z)	m	
Observer-Target Range		R	m	
Observer Zenith Angle	Φ_0	IOBSZ	degrees	90.0
Observer Azimuth Angle	Φ_0	PHLOS	degrees	
Field Azmuth Angle	Θ_S	PHNOR	degrees	

Figure A-73. LASS Line Of Sight (LOS) Definition Screen

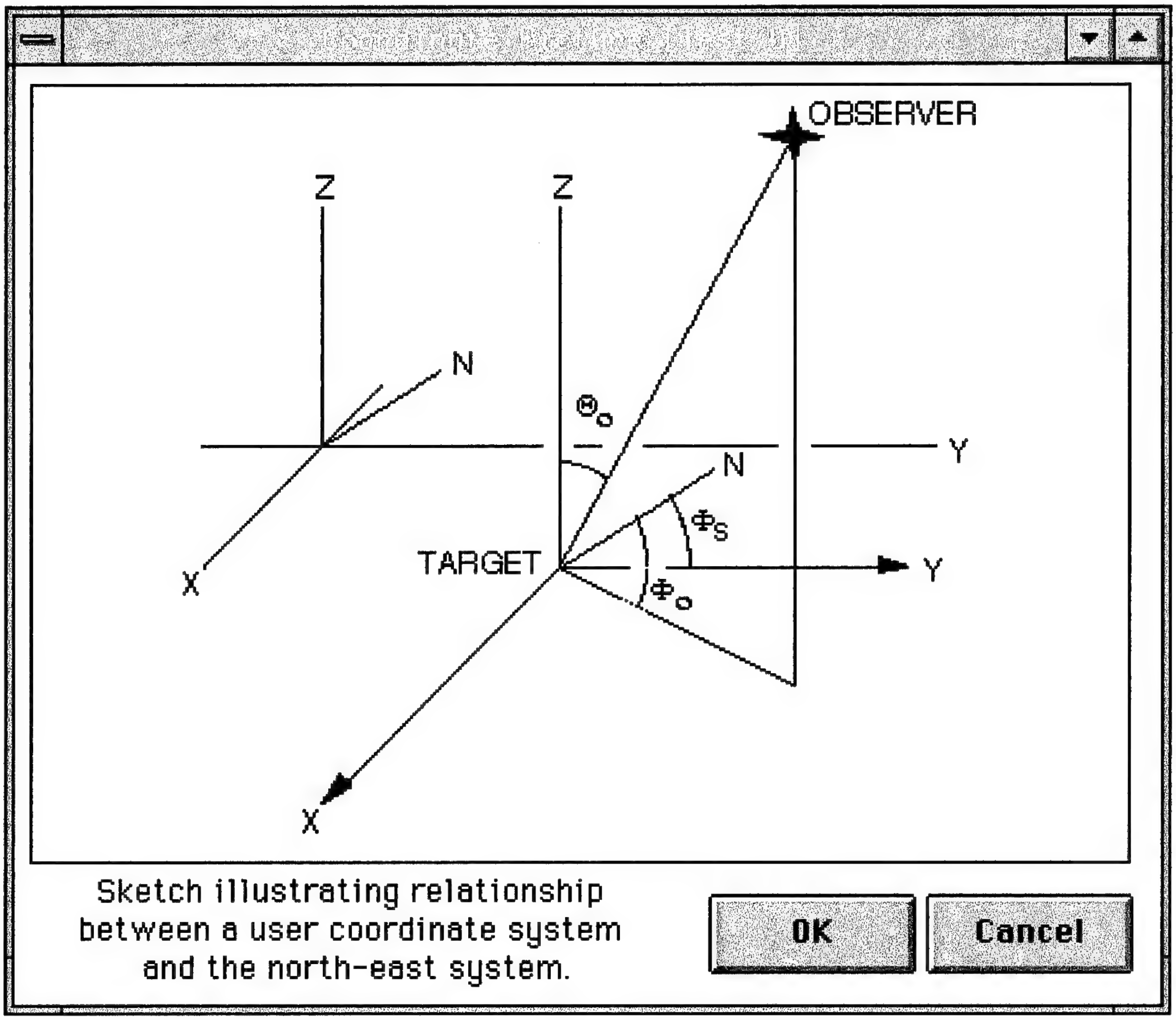


Figure A-74. LASS Coordinate Picture Screen

The Source Centerline Coordinates screen captures data found on the LINE card and is shown in Figure A-75.

Source Centerline Coordinates

Parameter		Code Variable	Units	User Values
Coordinates	X	XS(1)	m	
	Y	YS(1)	m	
Number of Sources		XNUM	-	
Line Length		SLEN	m	
Angle Between Wind Direction and Deployment Line Normal		PSI	degrees	

OK Cancel

Figure A-75. LASS Source Centerline Coordinates Screen

The Munitions and Obscurant Data screen captures data found on the SRCD card and is shown in Figure A-76.

Munition and Obsurant Data

Parameter	Code Variable	Units	User Values
Mass Emission Rate	QEMIS	g/s	
Efficiency	EFF	%	
Yield Factor	YF	-	
Mass Extinction Coefficient	EXTCO	m^2/g	
Source Height Above Surface	ZSRC	-	
Evaporation Constant	F1	-	
Evaporation Time Scale	F2	s	

OK Cancel

Figure A-76. LASS Munitions and Obscurant Data Screen

The Meteorological screen captures data found on the MET1 card and is shown in Figure A-77. The user must specify whether to use CLIMAT data or user specified the data. When the user chooses to use CLIMAT data, the other parameters will become inactive. This data on this screen is required. Note that based on the current documentation, LASS does not specify whether input can be taken from CLIMAT but the potential is present to do so. This implementation assumes this capability will be added.

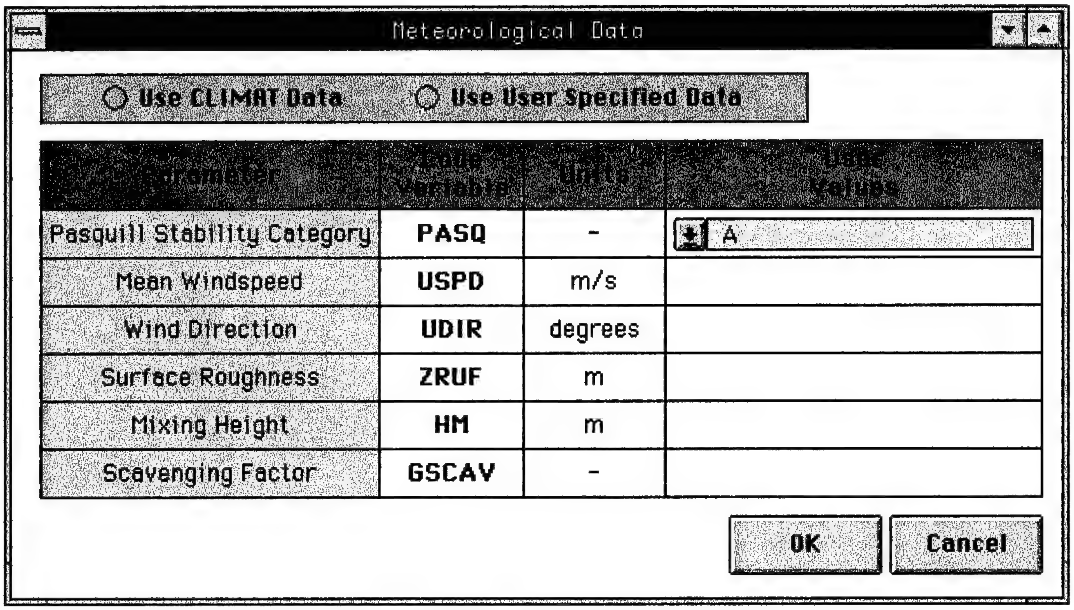


Figure A-77. LASS Meteorological Screen

The Contour Map Parameters screen captures data found on the CMAP card and is shown in Figure 78.

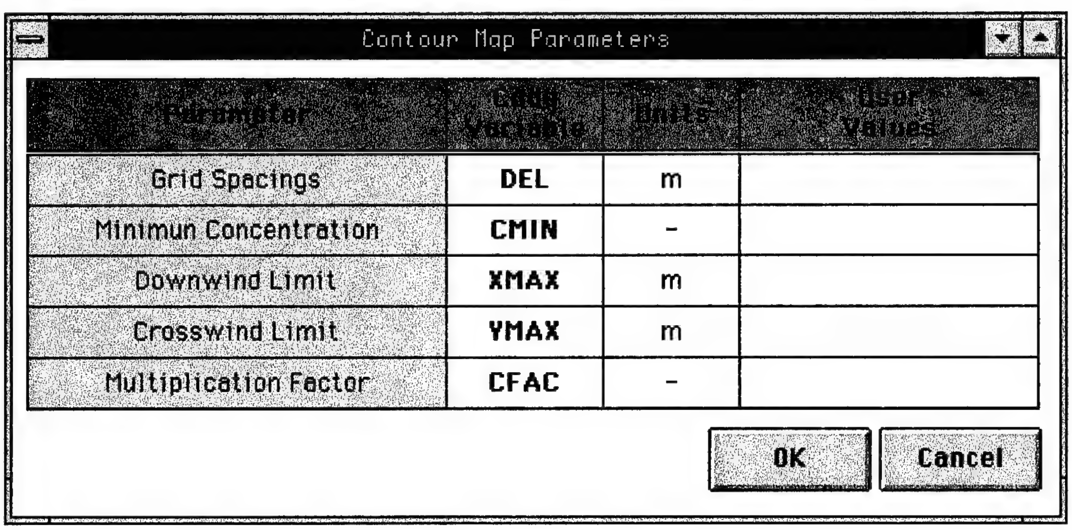


Figure A-78. LASS Contour Map Parameters Screen

The Plot screen captures data found on the PLOT card and is shown in Figure A-79.

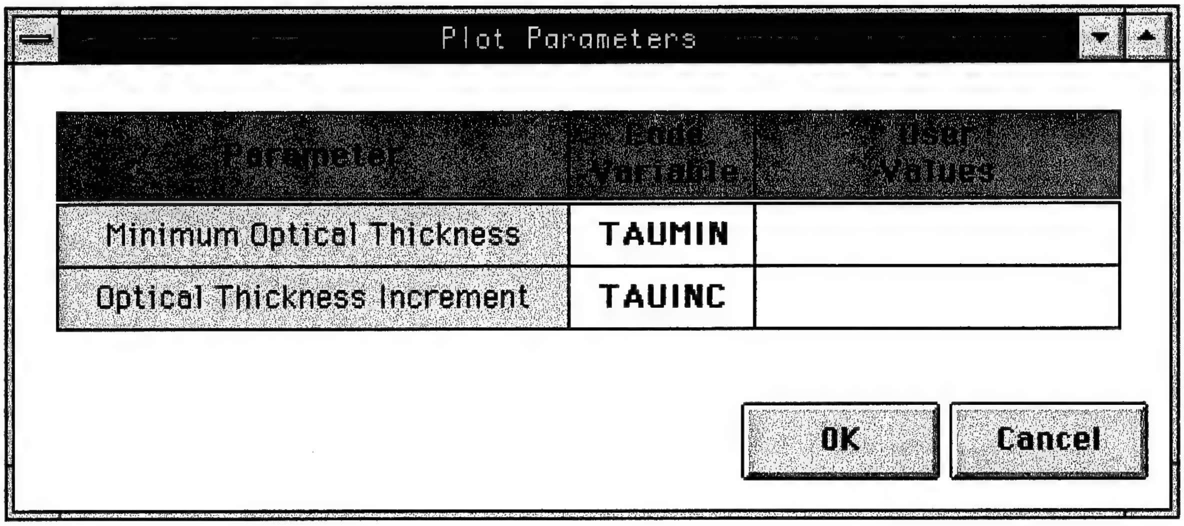


Figure A-79. LASS Plot Screen

The Source Data screen captures data found on the SCRL card and is shown in Figure A-80. This screen captures the location of the generators and can be repeated. By using the Add and Delete buttons the user can add another screen or delete the current screen. The user can move through the screens by using the arrows at the top of the screen. The top line displays to the user which screen he is presently viewing for example 1 of 1. This data could be gathered in a point and click laydown as in the observer and target screen in COMBIC. This is discussed in Section 3.6, COMBIC Module Prototype Development. This will be an implementation decision made in Phase II.

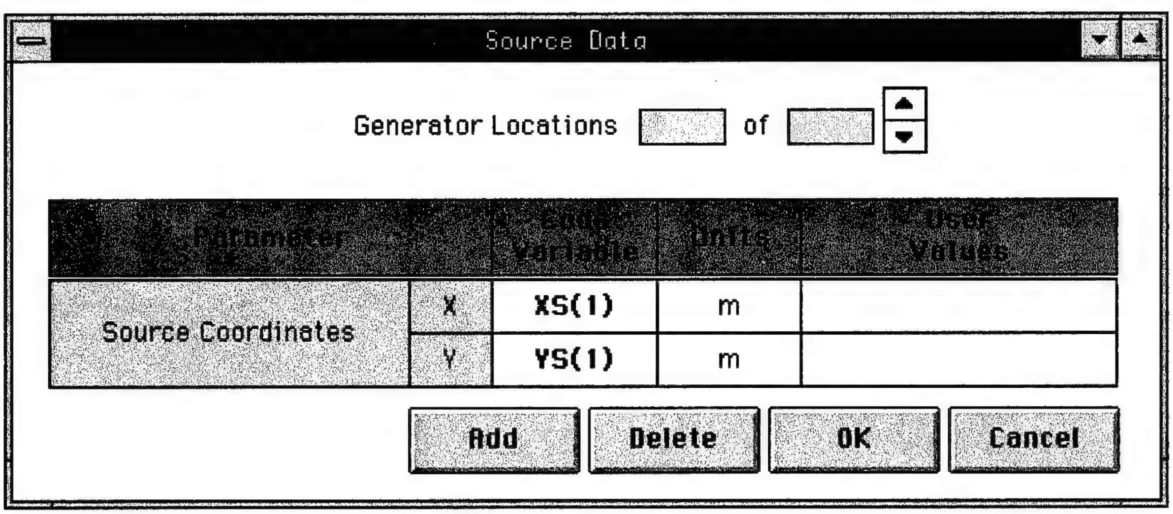


Figure A-80. LASS Source Data Screen

The Options screen captures data found on the OPTN card and is shown in Figure 81.

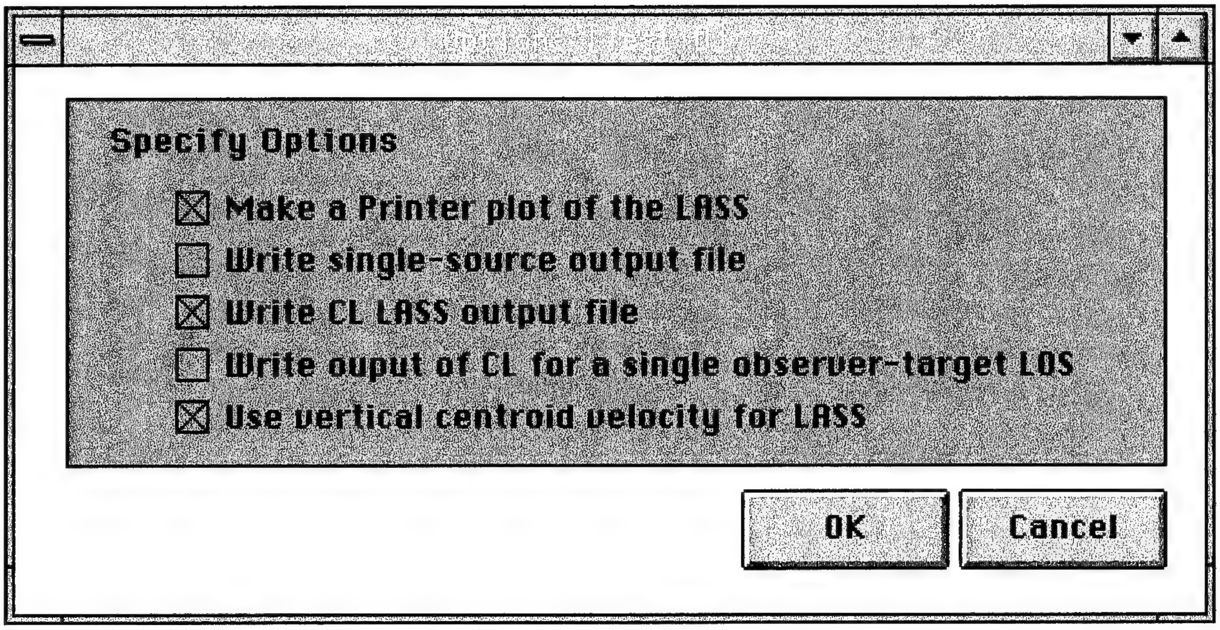


Figure A-81. LASS Options Screen

The Obscurant Optical Properties screen captures data found on the OBSC card and is shown in Figure A-82.

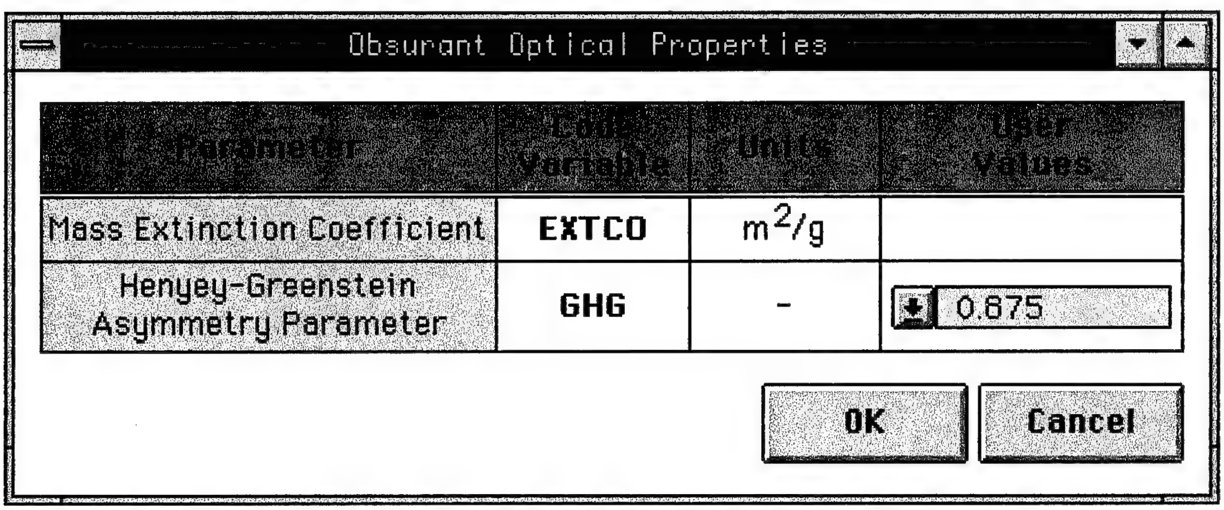


Figure A-82. LASS Obscurant Optical Properties Screen

The Solar and Sky Data screen captures data found on the SOLR card and is shown in Figure A-83.

Solar and Sky Data

Parameter	Code Variable	Units	Typical Values	User Values
Solar flux	FSOL	W/m^2	-	
Solar Zenith Angle	ISOLMU	degrees	-	25.8
Solar Azimuth Angle	SOLPHI	degrees	-	
Surface Albedo	ALBDO	-	0.0 - 1.0	
Sky Radiance	SKY	W/m^2	-	

OK Cancel

Figure A-83. LASS Solar and Sky Data Screen

The Target and Background Albedos screen captures data found on the ALBO card and is shown in Figure A-84.

Target and Background Albedos

Parameter	Code Variable	Units	User Values
Target Albedo	TGTALB	-	
Background Albedo	BCKALB	-	

OK Cancel

Figure A-84. LASS Target and Background Albedos Screen

The Azimuth Calculations screen captures data found on the RTAZ card and is shown in Figure A-85.

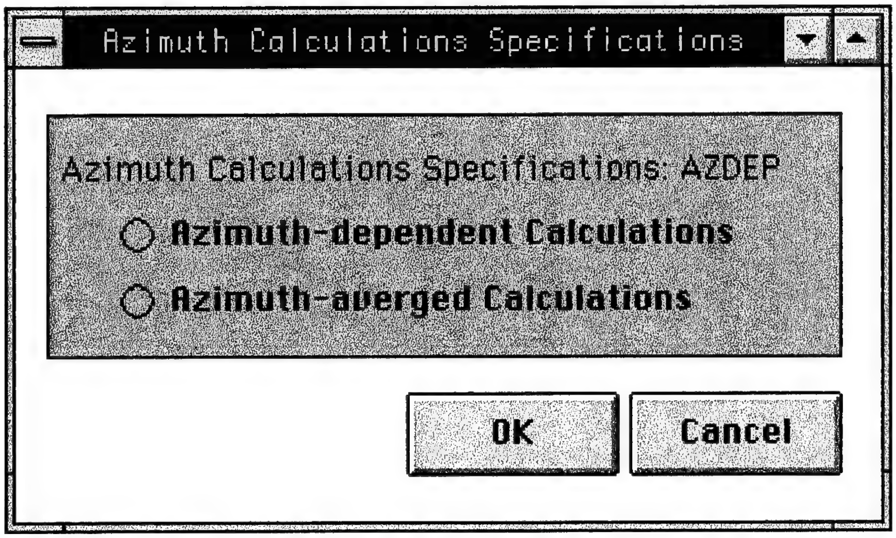


Figure A-85. LASS Azimuth Calculations Screen

A.10 Laser Transmission (LZTRAN) Module

The Laser Transmission (LZTRAN) module calculates molecular absorption coefficients for specific laser frequencies. The LZTRAN documentation was unclear in some areas. This implementation is based on our current interpretation. The things which were unclear will be resolved before the final implementation in Phase II. The documentation also did not indicate which cards are required. This will also be resolved before final implementation. LZTRAN accepts wavelength from EOEXEC driver. Figure 86 shows the Input Menu Choices. Input is captured in 3 input screens: Atmospheric, Altitude, Temperature and Water Pressure Profiles, and Target and Laser Positions.

LZTRAN

Input Menu
Atmospheric Data
Target and Laser Positions
Altitude, Temperature and Water Vapor Pressure Profiles

Figure A-86. LZTRAN Input Menu Choices Input

The Atmospheric screen incorporates data found on the ATMO card. This screen is illustrated in Figure 87. The Model Atmosphere Type parameter determines the value of the Mean Scale Height parameter and this is reflected in the displayed value. An exception is when the user choices User Specified for Model Atmosphere Type, then the user must specify the Mean Scale Height.

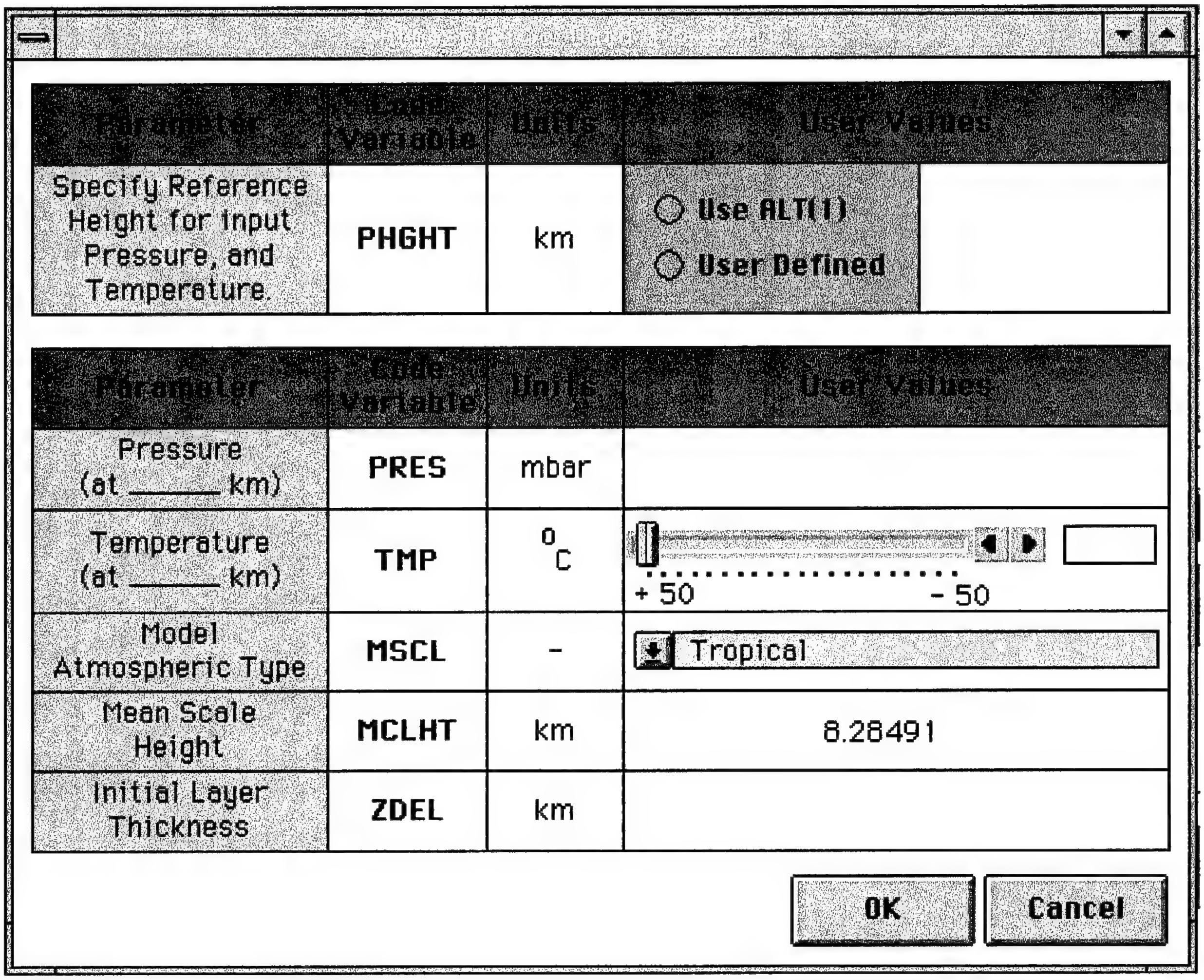


Figure A-87. LZTRAN Atmospheric Screen

The Altitude, Temperature and Water Pressure Profiles screen incorporates data found on the ALTL, TEMP, and PH20 cards. This screen is illustrated in Figure A-88. The user chooses from a pull down menu for each variable. Corresponding values for Altitude, Temperature and Water Vapor Pressure change accordingly. If the user chooses the User Specified option, then the cells for the corresponding parameters become active and the user must specify the data.

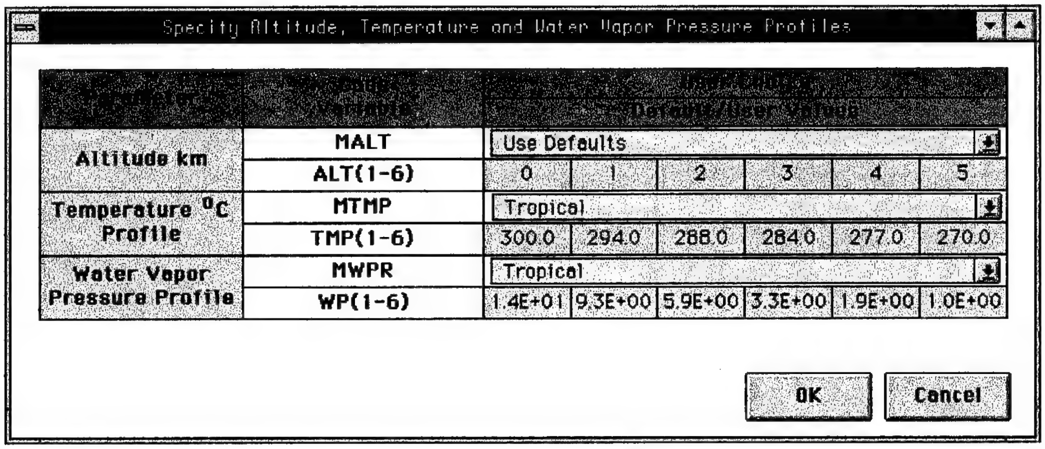


Figure A-88. LZTRAN Altitude, Temperature and Water Pressure Profiles Screen

The Target and Laser Positions screen incorporates data found on the TARG, and DESG cards. This screen is illustrated in Figure A-89. This screen could also be implemented as a point and click lay down on a grid as in COMBIC. This implementation decision will be made in Phase II.

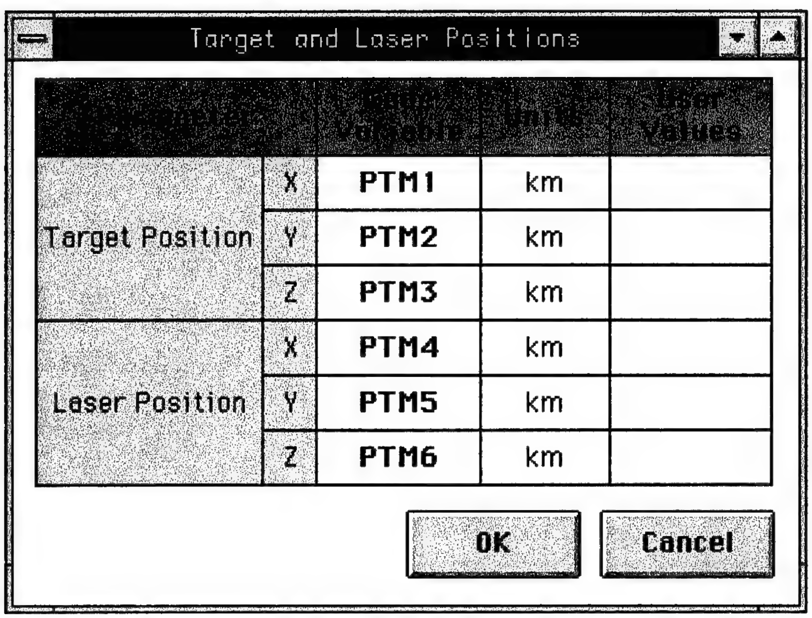


Figure A-89. LZTRAN Target and Laser Position Screen

A.11 Missile Smoke Plume Obscuration (MPLUME) Module

The Missile Smoke Plume Obscuration (MPLUME) module will predict obstruction and imaging system degradation of helicopter designation systems caused by smoke from a missile plume. The user can specify data for multiple runs. The MPLUME documentations user's guide section did not breakdown the input by card though the examples were given by card input. The data was gathered into a presumable card layout to stay consistent with other modules. Any errors will be resolved before final implementation. MPLUME documentation does not indicate that input can be supplied by other modules, but does state that MPLUME is called by other modules. Those modules are not identified. Figure A-90 shows the Input Menu Choices. MPLUME input screens are Atmospheric, Seeker, Target, Contrast, FLIR, TV, Missile and Radiance.

MPLUME

<u>Input Menu</u>
Atmospheric
Seeker Data
Target Data
Contrast Data
FLIR Data
TV Data
Missile Data
Radiance Data

Figure A-90. MPLUME Input Menu Choices

The Atmospheric screen is shown in Figure A-91 and incorporates data from the ATMOS card. The user must choose to use data from CLIMAT or specify the data. If the user chooses to the CLIMAT option, all input cells will become inactive. Current documentation does not indicate use of the CLIMAT option, but the potential is there and this implementation assumes it will be added. Data on this screen are required.

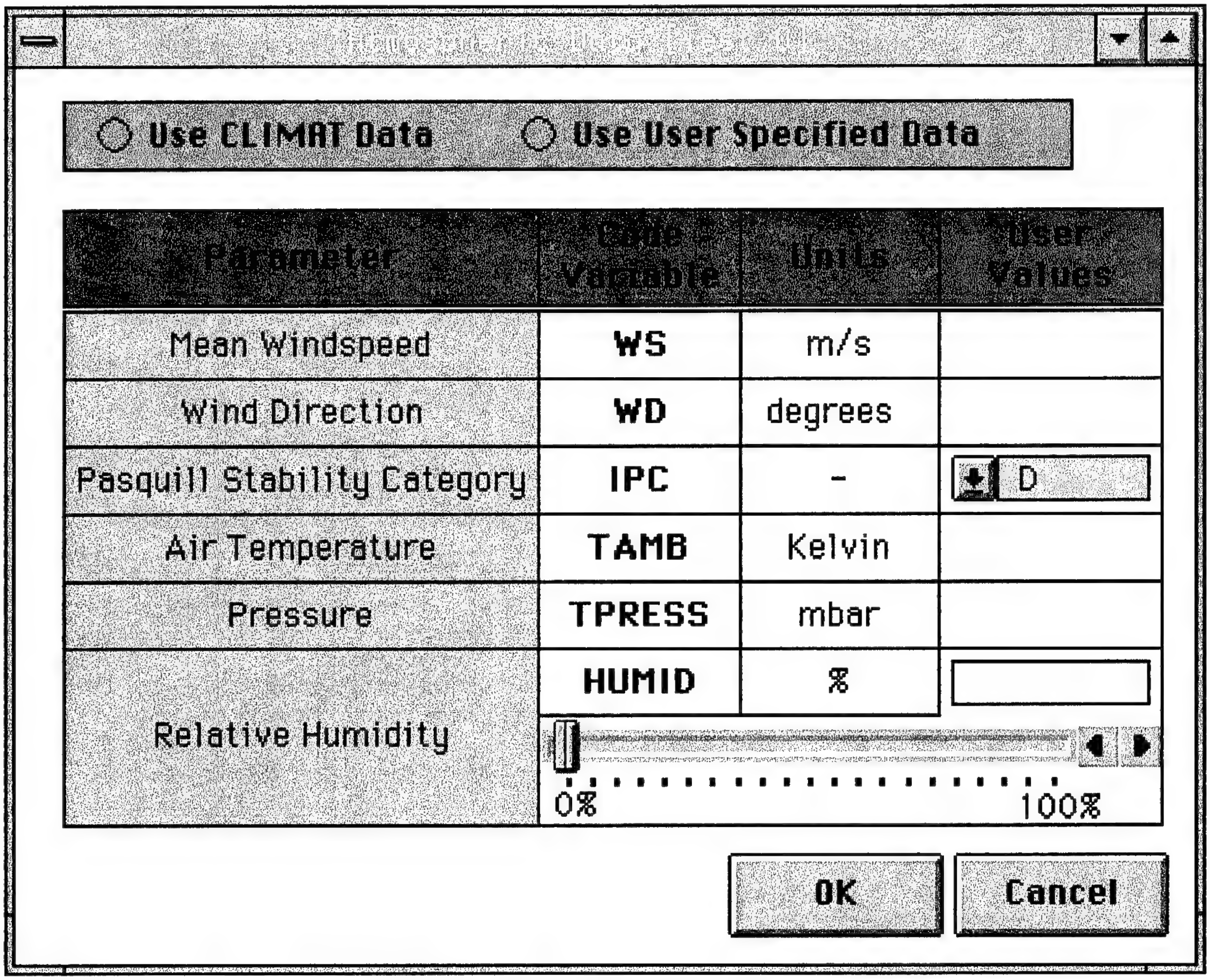


Figure A-91. MPLUME Atmospheric Screen

The Seeker screen is shown in Figure A-92 and incorporates data from the SEEK card. The Target screen in shown in Figure A-93 and incorporates data from the TARG card. The coordinates of the seeker and the target could also be determined by a lay down option like that in the COMBIC model. This implementation option will be determined in Phase II. Data gathered on both screens are required.

Seeker Data

Parameter		Code Variable	Units	Values
Coordiates	X	XH	m	
	Y	YH	m	
	Z	ZH	m	

OK Cancel

Figure A-92. MPLUME Seeker Screen

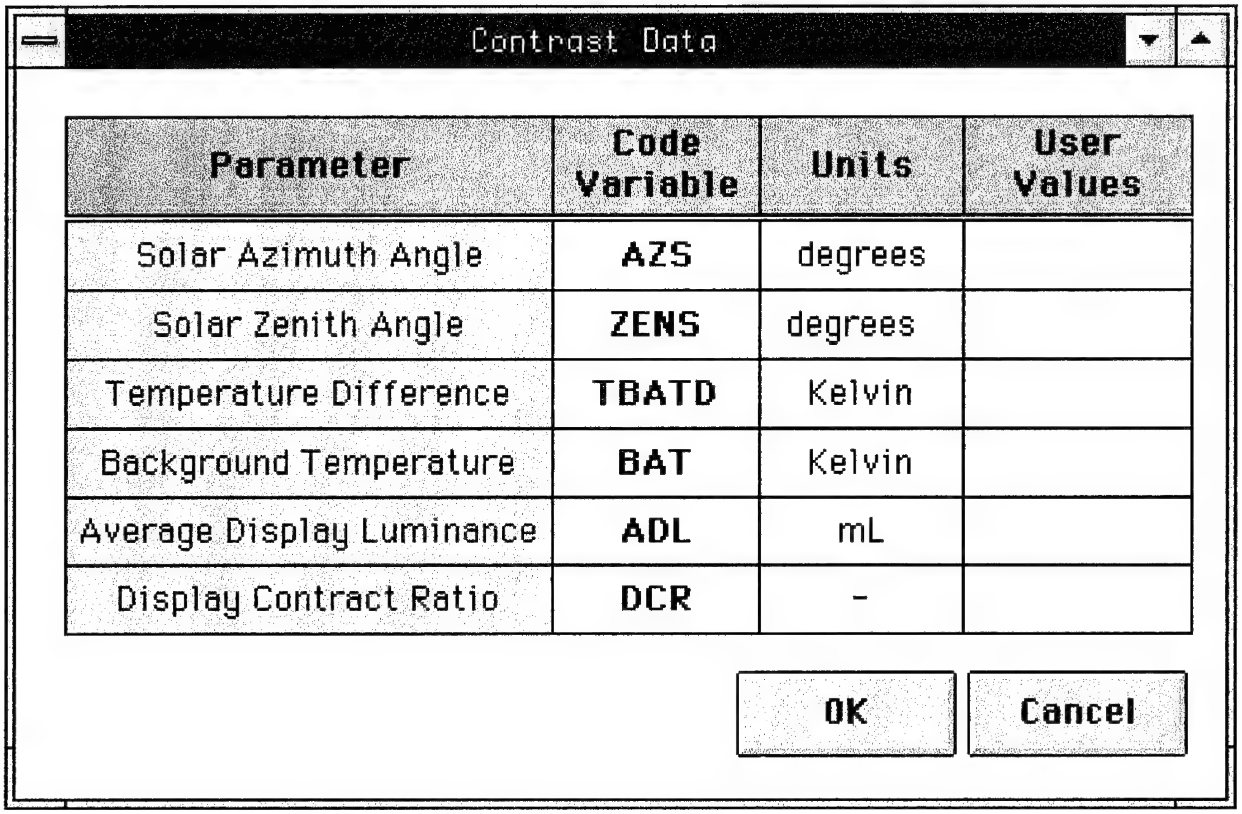
Target Data

Parameter		Code Variable	Units	Values
Coordiates	X	XT	m	
	Y	YT	m	
	Z	ZT	m	
Height		TH	m	
Width		TW	m	

OK Cancel

Figure A-93. MPLUME Target Screen

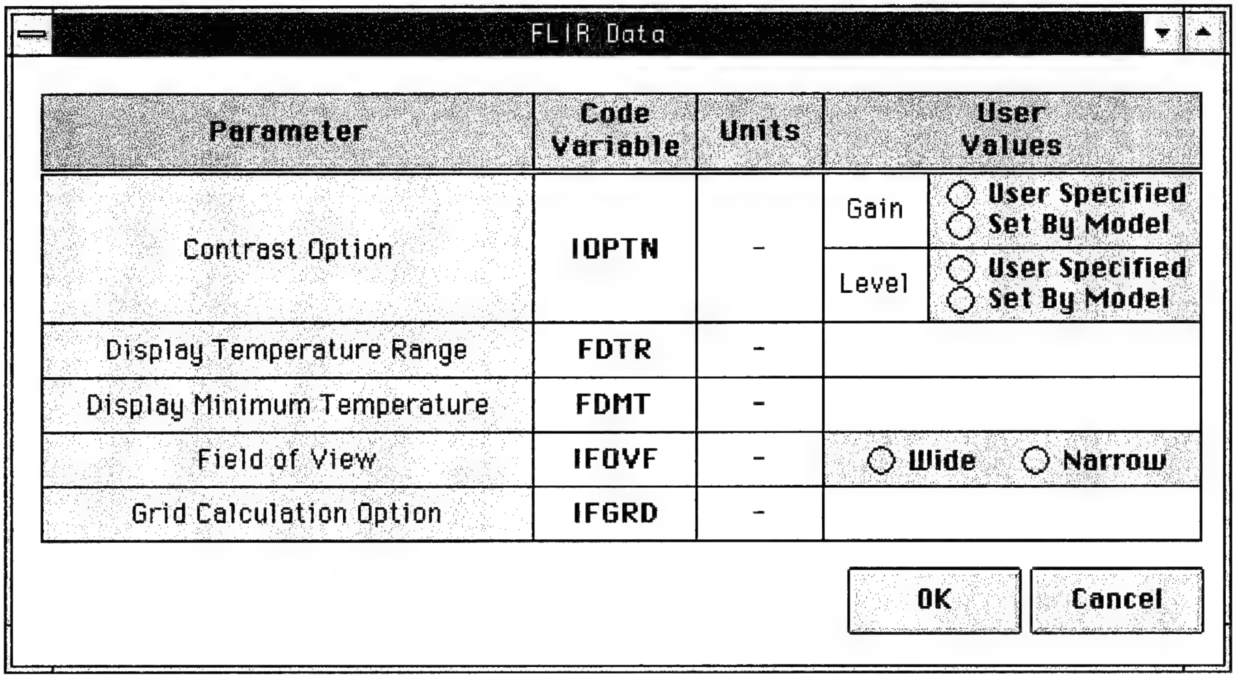
The Contrast screen is shown in Figure A-94 and incorporates data from the CONT card. Data on this screen are required.



Parameter	Code Variable	Units	User Values
Solar Azimuth Angle	AZS	degrees	
Solar Zenith Angle	ZENS	degrees	
Temperature Difference	TBATD	Kelvin	
Background Temperature	BAT	Kelvin	
Average Display Luminance	ADL	mL	
Display Contract Ratio	DCR	-	

Figure A-94. MPLUME Contrast Screen

The FLIR screen and the TV screen is shown in Figure A-95 and A-96 incorporate data from the FLIR and TV cards receptively. Data gathered on either screen are not required.

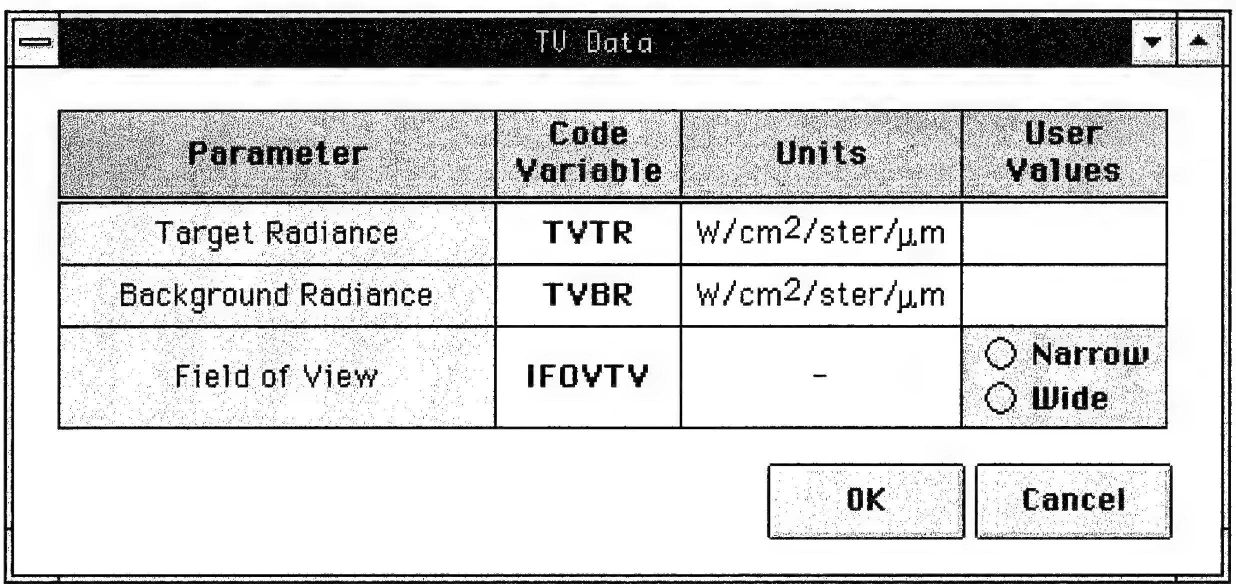


FLIR Data

Parameter	Code Variable	Units	User Values	
Contrast Option	IOPTN	-	Gain	○ User Specified ○ Set By Model
			Level	○ User Specified ○ Set By Model
Display Temperature Range	FDTR	-		
Display Minimum Temperature	FDMT	-		
Field of View	IFOVF	-	○ Wide ○ Narrow	
Grid Calculation Option	IFGRD	-		

OK Cancel

Figure A-95. MPLUME FLIR Screen



TV Data

Parameter	Code Variable	Units	User Values
Target Radiance	TVTR	W/cm2/ster/µm	
Background Radiance	TVBR	W/cm2/ster/µm	
Field of View	IFOVTV	-	○ Narrow ○ Wide

OK Cancel

Figure A-96. MPLUME TV Screen

The Missile screen, shown in Figure A-97, incorporates data from the MISSILE card. The coordinates of the missile could also be determined by a lay down option like that in the COMBIC model. Data on this screen are required.

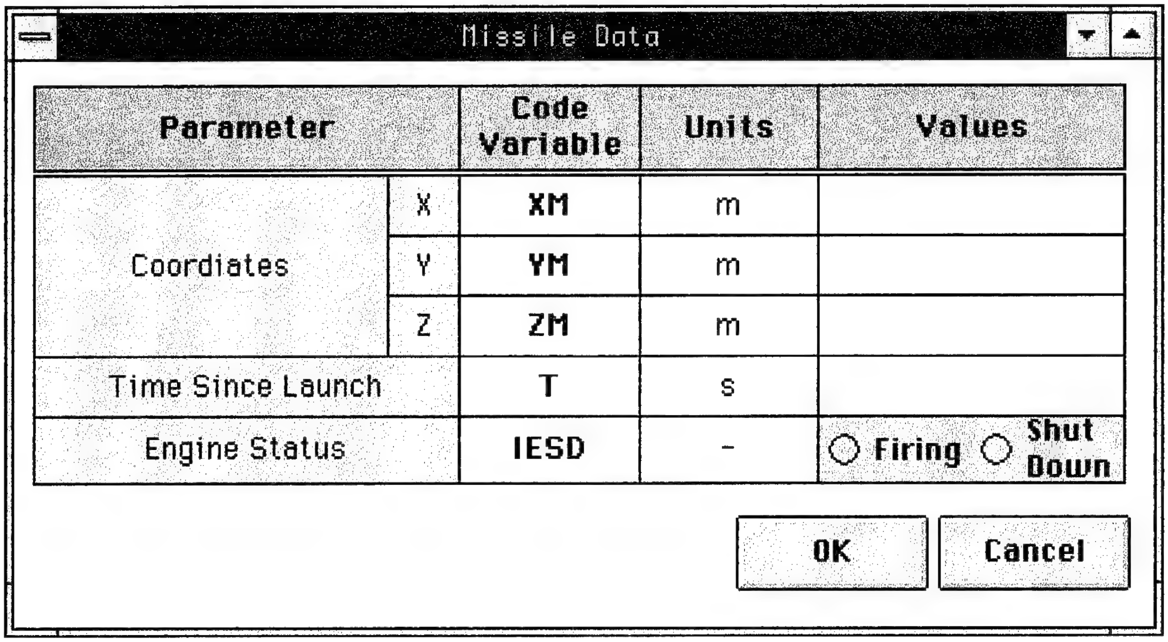


Figure A-97. MPLUME Missile Screen and TV Screen

The Radiance screen, shown in Figure A-98, incorporates data from the RADN card. Data on this screen are required.

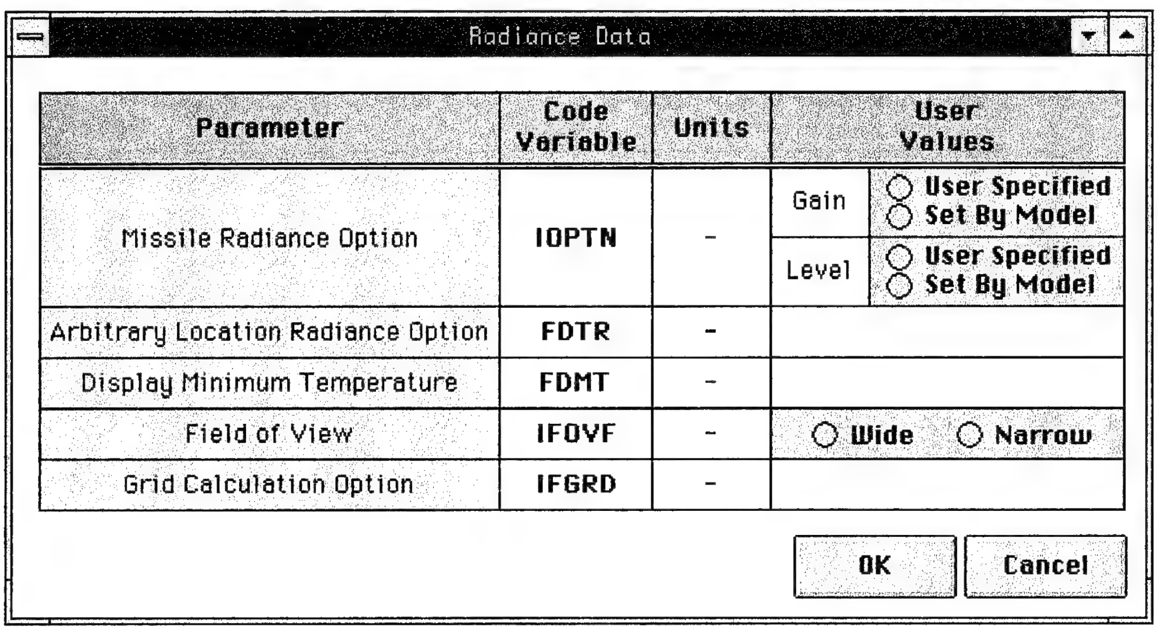


Figure A-98. MPLUME Radiance Screen

A.12 Narrow Beam Multiple Scattering (NBSCAT) Module

The Narrow Beam Multiple Scattering (NBSCAT) module is a multiple scattering propagation model applicable to narrow light beams transmitted through aerosol clouds. The user may use Aerosol data from a previous NBSCAT run as input. No other special input or interaction with other modules is mentioned in the documentation. Figure A-99 shows the Input Menu Choices. NBSCAT input screens are Source, Run, Receiver, Medium and Aerosol Parameters.

NBSCAT

Input Menu
Run Parameters
Source Parameters
Receiver Parameters
Medium Parameters
Aerosol Parameters

Figure A-99. NBSCAT Input Menu Choices

The Run Parameter screen is shown in Figure A-100 and incorporates data from the RUNP card. Data on this screen are required.

Run Parameters

Parameter	Code Variable	Units	User Values
Number of Radial Positions	LRMAX	-	
Maximum Radial Position	RMAX	cm	
Calculation Option		**Calculate?**	
Transmitted On-Axis Power	ITRANS	○ No ○ Yes	
Range-resolved Lidar Return	ILIDAR	○ No ○ Yes	
Transmitted On-Axis Power	ITRPRO	○ No ○ Yes	
Lidar Profile	ITRPRO	○ No ○ Yes	

OK Cancel

Figure A-100. NBSCAT Run Parameter Screen

The Source Parameter screen is shown in Figure A-101 and incorporates data from the SORC card. Data on this screen are required.

Source Parameters

Parameter	Code Variable	Units	User Values
Position	**ZSD**	km	
Maximum Radial Position	**WO**	cm	
Transmitted On-Axis Power	**BEAMD**	cm	
Range-Resolved Lidar Return	**BEAMQ**	-	

OK **Cancel**

Figure A-101. NBSCAT Source Parameter Screen

The Receiver Parameter screen is shown in Figure A-102 incorporates data from the DETR card. Data on this screen are required.

Parameter	Code Variable	Units	User Values
Calculation Position for the Transmitted Irradiance Profile and/or the On-Axis Received Power	**ZDTD**	km	
Calculation Position for the Lidar Profile and/or the On-Axis Lidar Return	**ZDLD**	km	
Radius of On-axis Transmission Receiver	**DRTD**	cm	
Radius of On-Axis Lidar Receiver	**DTLD**	cm	
Half Angle Field of View of Transmission Reciever and Transmitted Irradiance Profile	**FOVT**	rad	
Half Angle Field of View of Lidar Receiver and Lidar Profile	**FOVL**	rad	

OK **Cancel**

Figure A-102. NBSCAT Receiver Parameter Screen

The Medium Parameter screen and the TV screen is shown in Figure A-103 incorporates data from the MEDP card. Data on this screen are required.

Medium Parameters

Parameter	Code Variable	Units	User Values
Molecular Absorption Coefficient	**ALMD**	km^{-1}	

OK **Cancel**

Figure A-103. NBSCAT Medium Parameter Screen

The Aerosol Parameter screen, shown is Figure A-104 and A-105, incorporates data from the AERP card. Data on this screen are required. The user must choose to read aerosol scattering properties from phase function file or use aerosol cloud parameters from a previous NBSCAT run. Based on the users choice, the data cells on this screen will change accordingly.

○ **Read Aerosol Angular Scattering Properites From Phase Function File**

○ **Use Aerosol Cloud Parameters From Previous NBSCAT Run**

Parameter	**Code Variable**	**Units**	**User Values**
Number of Range Positions	**NIH**	-	
Cloud Depth	**ZCD**	km	
Refernce Position	**ZD**	-	
Number of Different Aerosol Types to be Mixed at Reference Position	**NMIX**	km	
Cloud Extenction Coeffiecint at Reference Position	**ALPE**	km	
Phase Function Identifier	**IDPF**	-	
Aerosol Weight	**WGT**	-	

OK **Cancel**

Figure A-104. NBSCAT Aerosol Parameter Screen

○ Read Aerosol Angular Scattering Properties From Phase Function File

○ Use Aerosol Cloud Parameters From Previous NBSCAT Run

Parameter	Mnemonic	Units	User Values
Number of Range Positions	NIH	km	
Cloud Depth	ZCD	km	
Refernce Position	ZD	rad	
Number of Different Aerosol Types to be Mixed at Reference Position	NMIX	km^{-1}	
Cloud Extenction Coeffiecint at Reference Position	ALPE	km	
Forward Scattering Coefficient	ALSPD	km^{-1}	
Backscattering Coefficient	ALSMD	km^{-1}	
Absorption Coefficient	ALAD	km^{-1}	
The Product $C^{+} < \sin\theta^{+} >$	DIFP	-	
The Product $C^{-} < \sin\theta^{-} >$	DIFM	-	
Phase Function Identifier	SAPD	rad	
Forward Scattering Coefficient	SAPM	rad	
Backscattering Coefficient	BETAD	km^{-1}/sr	

OK Cancel

Figure A-105. NBSCAT Aerosol Parameter Screen

A.13 Near Millimeter Wave (NMMW) Module

The Near Millimeter Wave (NMMW) module calculates any combination of the following cases:

a. Oxygen refraction and absorption.
b. Water vapor and oxygen refraction and absorption
c. Water or ice fog, extinction and back scatter

d. Drizzle, widespread, or thunderstorm rain extinction and backscatter
e. Dry, moist or wet snow extinction and backscatter.

NMMW can receive wavelength from the EOEXEC driver. The user can supply data for multiple runs. Climatology data can be supplied by CLIMAT. Figure A-106 shows the Input Menu Choices. The input screens for NMMW are General Parameters and Meteorological Data.

NMMW

Input Menu
General Parameters
Meteorological Data

Figure A-106. NMMW Input Menu Choices

The General Parameters screen captures data found on the PATH, FOG, RAIN and SNOW cards and is shown in Figure A-107. These data are required.

NMMW General Parameters

Parameter	Code Variable	Units	User Values
Rain Rate	RAINRT	mm/hr	
Rain Type	RTYPE	-	○ Drizzle ○ Wide Spread ○ Thunderstrom
Snow Rate	SNOWRT	mm/hr	
Path Length	MMWPTH	km	
Fog Density	FOGDEN	g/m^3	

OK Cancel

Figure A-107. NMMW General Parameters Screen

The Meteorological Data screen captures data found on the METR card and is shown in Figure A-108. The user must choose to either use the CLIMAT data, which inactivates all parameters or specify the data.

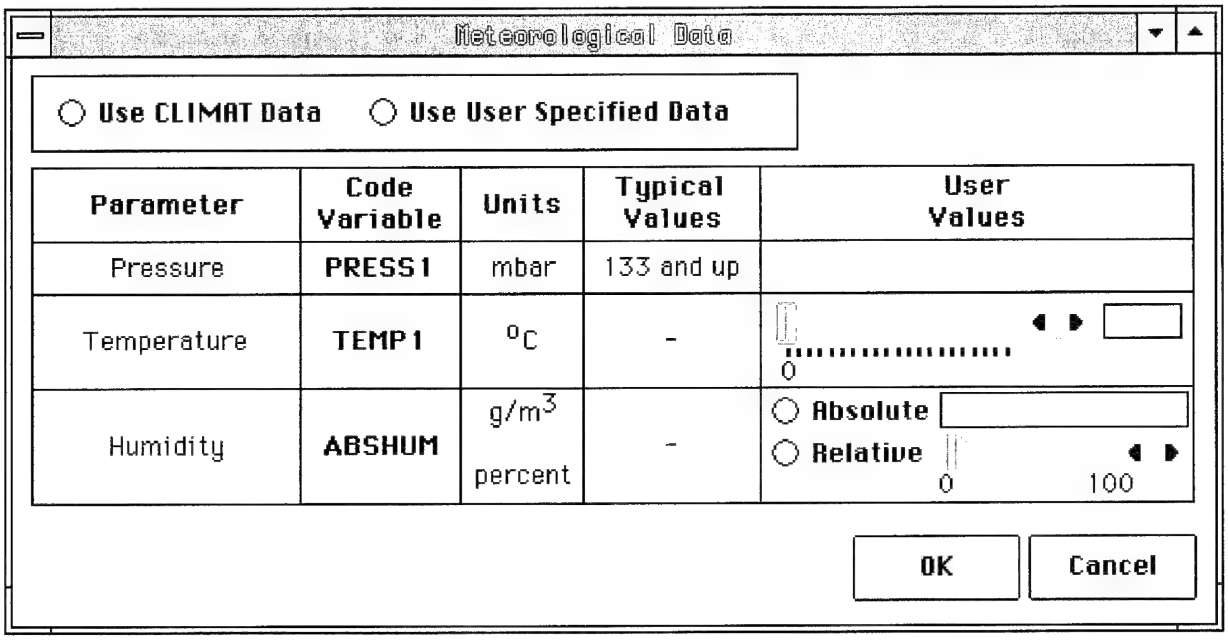


Figure A-108. NMMW Meteorological Data Screen

A.14 Nonlinear Aerosol Vaporization and Breakdown Effects (NOVAE) Module

The nonlinear aerosol vaporization and breakdown effects (NOVAE) module computes both aerosol breakdown and vaporization effects on High Energy Laser (HEL) propagation in the repetitive pulse mode and only aerosol vaporization effects in the continuous wave mode. The user can specify input for multiple runs. NOVAE can interact with CLIMAT to determine the wind speed and direction. Other interactions are not mentioned. NOVAE documentation did not indicate which screens were or were not required. Figure A-109 shows the Input Menu Choices. NOVAE input screens are Laser, Atmosphere and Environment, Target, Option and Control, Breakdown and Vaporization, Modeling and Computation Options, Aerosol and Cloud Characteristics, Vaporization Characteristics screen, Absorption and Extinction Coefficient Profiling, Wind Profile, and Stimulated Raman Scattering.

NOVAE

<u>Input Menu</u>
Laser
Atmosphere and Environment
Target
Option and Control
Breakdown and Vaporization
→ Modeling and Computation Options
→ Aerosol and Cloud Characteristics
→ Vaporization Characteristics
Absorption and Extinction Coefficient Profiling
Wind Profile
Stimulated Raman Scattering

Figure A-109. NOVAE Input Menu Choices

The Laser screen, shown in Figure A-110, incorporates data from the LAS1 and LAS2 cards.

Parameter	Code Variable	Units	User Values
Beam Diameter	DIAM	m	
Beam Power	POWER	kW	
Maximum Power	POWMAX	kW	
Energy per Pulse	ENGPUL	kJ	
Maximum Energy per Pulse	ENGMAX	kJ	
Fractional Obsuration	FOBS	-	
Pulse Repetition Frequency	PRF	Hz	
Time Duration of Pulse	TO	s	
Beam Quality in Times Diffraction Limited	TIMSDL	-	
One Sigma High Frequency Jitter Angle	THJH	μrad	
One Sigma Low Frequency Jitter Angle	THJL	μrad	
Aspect Ratio	ASPECT	-	
X-dimension Rectangular Aperature	XDIM	m	

OK Cancel

Figure A-110. NOVAE Laser Screen

The Atmosphere and Environment screen, shown in Figure A-111, incorporates data from the ATM1 and ATM2 cards. The user can use data determined by CLIMAT for the Wind Speed and Wind Direction. When this option is chosen, these parameters will become inactive.

○ Use CLIMAT Data ◉ Use User Specified Data

Parameter	Code Variable	Units	User Values
Magnitude of Wind	WINDO	m/s	
Reference Height	HWINDO	m	
Wind Direction Angle	ANGWND	$(x)^{0}$	
Exponent in Wind Power law	WNDPOW	-	
Square of Refraction Index Structure Constant	CNSQO	$m^{2/3}$	
Exponent in Power Law for Refractive Index Structure Constant	CNSQPW	-	
Vertical Profile Option	CN2FLAG	-	○ On ○ Off
Quantity Constant	SCRPTS	m^3	
Absorption Coefficient	ABSOR	1/km	
Scattering Coefficient	ABSSCA	1/km	
Scale Height for Absorption Coefficient	HA	km	
Scale Height for Scattering Coefficient	HS	km	
Height of Aperature	HTDEV	m	
Target Height	HTTAR	m	

OK Cancel

Figure A-111. NOVAE Atmosphere and Environment Screen

The Target screen, shown in Figure A-112, incorporates data from the TAR1 and TAR2 cards.

Target

Parameter		Code Variable	Units	User Values
Range From Laser		RANGE	km	
Defocusing Increment		DRNGFO	km	
Range to Projected Impact Point		RMT	km	
Projected Impact Point Coordiantes	X	XT	km	
	Y	YT	km	
Trajectory Angle		TRAJAN	$(x)^0$	
Bearing Angle		BEARAN	$(x)^0$	
Angular Slew Rate		SLUVEL	rad/s	

OK Cancel

Figure A-112. NOVAE Target Screen

The Option and Control screen, shown in Figure A-113, incorporates data from the CTRL card.

Parameter	Code Variable	Units	User Values
Radius of Circle	RAV	cm	
Laser Type	ICDWRP	-	○ Continuous Wave ○ Pulse Repetition
Waveform	IDBM	-	Dust/Non-vaporizing Materials
Slew Option Indicator	IDSLEW	-	Summary Output
Number of Integration Steps	NPT	-	
Tilt Control Option	CN2FLAG	-	○ No Tilt Control ○ Tilt Control Asssumed
Interaction of Linear Effects with Blooming Indicator	IDTLCO	-	○ High Frequency Effects Included in Beam Size Before Blooming Calculations ○ All Linear Effects are Assumed After Blooming

OK Cancel

Figure A-113. NOVAE Option and Control Screen

The Breakdown and Vaporization screen, shown in Figure A-114, allows the user to access the Modeling and Computation Options, Aerosol and Cloud Characteristics and Vaporization Characteristics screens.

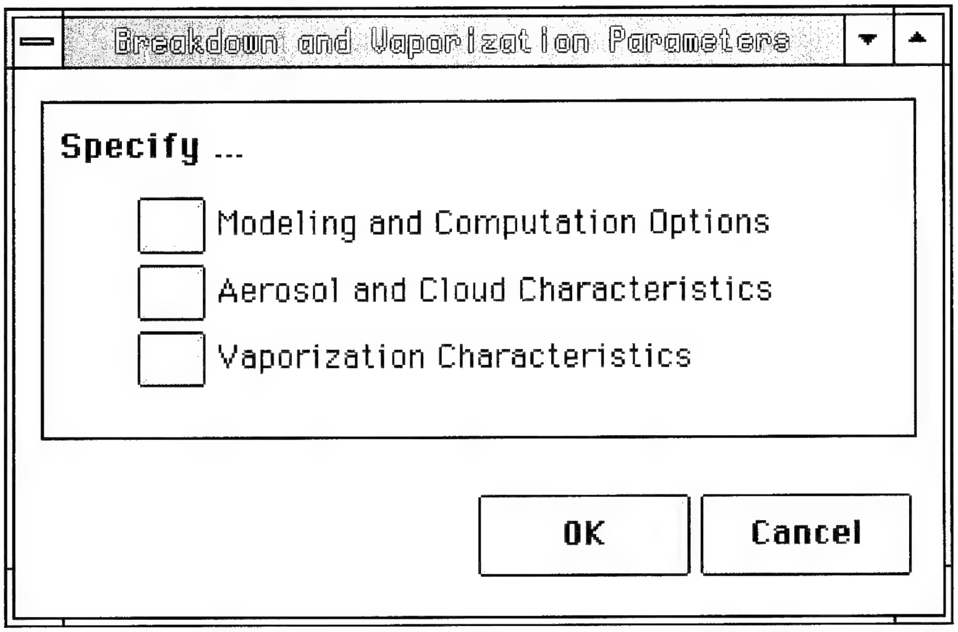


Figure A-114. NOVAE Breakdown and Vaporization Screen

The Modeling and Computation Options screen, shown in Figure A-115, incorporates data from the AVB1 card with the exception of the Aerosol Type (IAER) parameter which is found on the Aerosol and Cloud Characteristics screen. Based on the choice of the Mie Efficiency Factor Option, the AGAUS module may be called for the Mie data calculation. Additional AGAUS parameters are also needed. This data will also be gathered using GUI screens and these screen will be made available through the input menu when this choice is made.

Parameter	Code Variable	Units	User Values
Breakdown Option	IBRK	cm	○ Do Not Check for Breakdown ○ Check for Breakdown
Print Option	IPRTOP	-	Summary Output
Number of Phase Integral Steps in Cloud	NPA	-	
Recondensation Option	IRECON	-	○ Recondensation Neglected ○ Complete Recondensation Asssumed
Exponential Extinction Scaling Option	EXEXSC	-	○ Exponential Extinction Scaling Assumed ○ Exact Extinction Calculated
Mie Efficiency Factor Option	DATAP	-	○ Use Exact Mie Data Files ○ Use Approximate Mie Expressions ○ Call AGUAS Mie Data for Calculation

OK Cancel

Figure A-115. NOVAE Modeling and Computation Options Screen

The Aerosol and Cloud Characteristics screen, shown in Figure A-116, incorporates data from the AVB1, AVB2 and AVB3 cards.

Parameter	Code Variable	Units	User Values
Aerosol Type	**IAER**	-	Dust/Non-vaporizing Materials
Range to Leading Edge of Cloud	**RNGA**	km	
Cloud Length	**LA**	m	
Cloud Transmittance	**TA**	µm	
Air Temperature	**TATM**	K	
Air Pressure	**PATM**	atm	
Air Thermal Conductivity	**KAIR**	W/cm*K	
Relative Humidity	**RELH**	percent	0 100
Real Part of the Index of Refraction/ Mass Extinction Coefficient	**NR/MEC**	(m^3/g)	
Imaginary Part of the Index of Refraction/Mass Absorption Coefficient	**NI/MAC**	(m^3/g)	
Air Temperature	**TATM**	µm	
Air Pressure	**PATM**	-	
Air Thermal Conductivity	**KAIR**	K	
Air Pressure	**PATM**	(g/cm)	
Air Thermal Conductivity	**KAIR**	J/g*K	

OK **Cancel**

Figure A-116. NOVAE Aerosol and Cloud Characteristics Screen

The Vaporization Characteristics screen, shown in Figure A-117, incorporates data from the AVB4 card.

Vaporization Characteristics

Parameter	Code Variable	Units	User Values
Vapor Specific Heat	**CPV**	J/g*K	
Heat Vaporization	**LHA**	J/g	
Evaporation Coefficient	**EPSA**	-	
Vapor Diffusion Coefficient	**DCA**	cm /s	
Vapor Gas Constant	**RGA**	J/g*K	
Air Thermal Conductivity	**KAIR**	W/cm*K	
Vapor Molecular Weight	**MV**	g/mole	

OK Cancel

Figure A-117. NOVAE Vaporization Characteristics Screen

The Absorption and Extinction Coefficient Profiling screen, shown in Figure A-118, incorporates data from the APRO card.

Absorption and Extinction Coefficient Profiling

Parameter		Code Variable	Units	User Values
Absorption Coefficient Option		**IAEPRO**	km	
Coefficent from the Model	C_0	**C0**	km	
	C_1	**C1**	km	
	C_2	**C2**	km	
	C_3	**C3**	km	

$$\alpha = \exp(c_3x^3 + c_2x^2 - c_1x + c_0)$$

OK Cancel

Figure A-118. NOVAE Absorption and Extinction Coefficient Profiling Screen

The Wind Profile screen, shown in Figure A-119, incorporates data from the WPRO card.

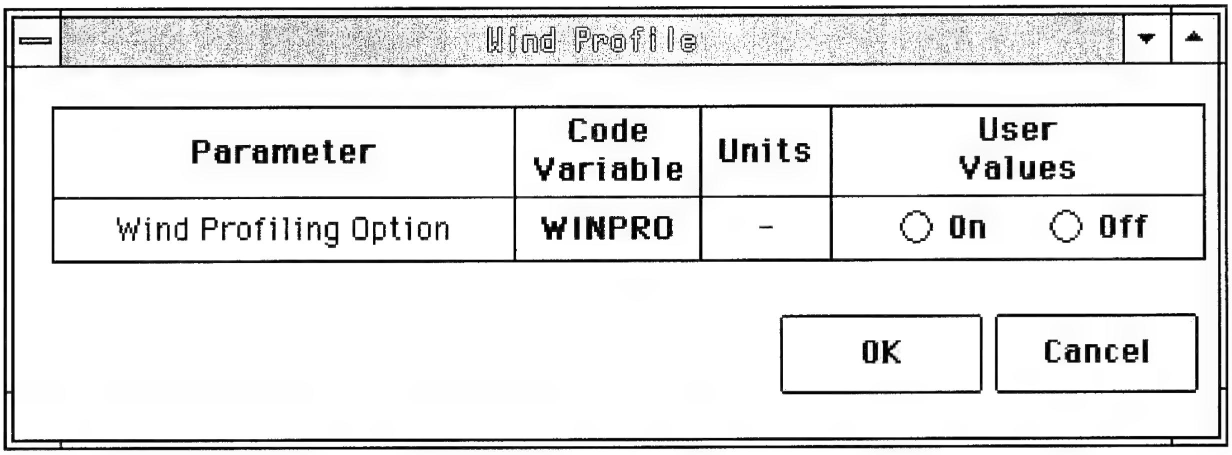


Figure A-119. NOVAE Wind Profile Screen

The Stimulated Raman Scattering screen, shown in Figure A-120, incorporates data from the ATM3 card.

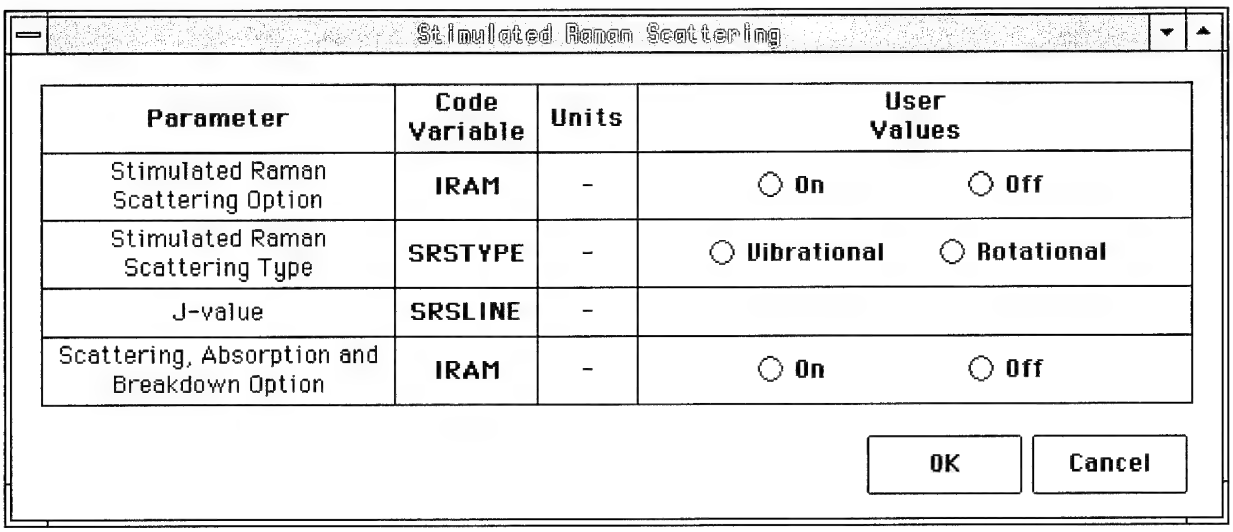


Figure A-120. NOVAE Stimulated Raman Scattering Screen

A.15 Millimeter Wave System Performance (RADAR) Module

The Millimeter Wave System Performance (RADAR) module calculated the range performance of millimeter wave systems. The user may define data for multiple runs. Radar documentation does not indicate which data cards are optional and which are required. Figure A-121 shows the Input Menu Choices. RADAR input screens are Options, Transmission, Beam, Detection, Atmospheric, Antenna Loss, Target, Dielectric, and Clutter.

RADAR

Input Menu
Options
Transmission
Beam
Detection
Atmospheric
Antenna
Target
Dielectric
Clutter

Figure A-121. RADAR Input Menu Choices

The Options screen, shown in Figure A-122, incorporates data from the INDC card.

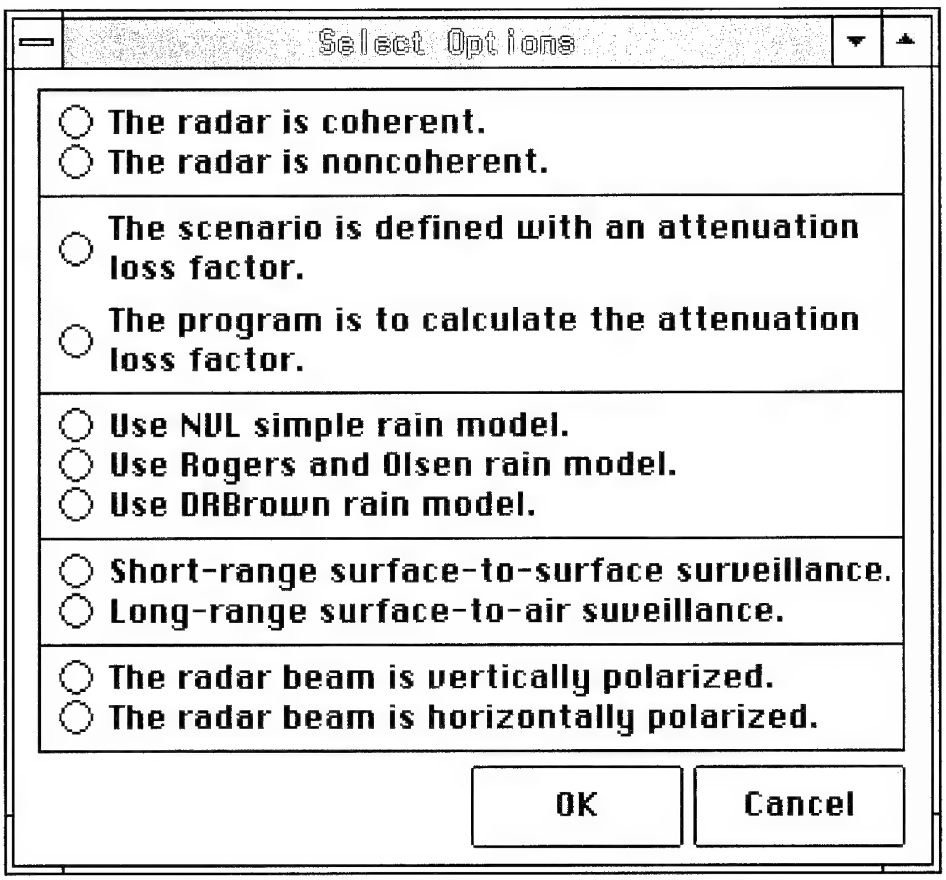


Figure A-122. RADAR Options Screen

The Transmission screen, shown in Figure A-123, incorporates data from the TRAN card.

RADAR Transmission Data

Parameter	Code Variable	Units	User Values
Receiver Noise Factor	ANF	dB	
Bandwidth Correction Factor	CB	dB	
Gain of Receiving Antenna	GR	dB	
Gain of Transmitting Antenna	hline GT	dB	
Transmitter Power	PT	Watts	
Pulse Length	TAU	μs	

OK Cancel

Figure A-123. RADAR Transmission Screen

The Beam screen, shown in Figure A-124, incorporates data from the BEAM card.

RADAR Beam Data

Parameter	Code Variable	Units	User Values
Antenna Height	AHFT	ft	
Radar Beamwidth in Azimuth	BWDA	degrees	
Radar Beamwidth in Elevation	BWDE	degrees	
Antenna Tilt	EL	degrees	
Scanning Frequency	SCMFQ	Hz	
Peak Sidelobe Ratio	SLDB	dB	
Wave Height	WHFT	ft	

OK Cancel

Figure A-124. RADAR Beam Screen

The Detection screen, shown in Figure A-125, incorporates data from the DETC card.

RADAR Detection Data

Parameter	Code Variable	Units	User Values
Probability of False Alarm	FA	-	
Swerling Fluctuation Case	KA	-	
Number of Pulses Integrated	NP	-	
Cumulative Probability Cutoff	PCREQ	-	
Probability of Detection	PD	-	
Maximum Probability of Detection	PDMAX	-	
Minimum Probability of Detection	PDMIN	-	

OK Cancel

Figure A-125. RADAR Detection Screen

The Atmospheric screen, shown in Figure A-126, incorporates data from the ATMO card.

RADAR Atmospheric Data

Parameter	Code Variable	Units	User Values
Fog Density	FD	g/m	
Solar and Galactic Noise	NS	-	
Rain Rate	RRATE	mm/hr	
Snow Rate	SNOWRT	mm/hr	
Snow Type	SNOWTP	-	Dry Snow
Surface Pressure	SP	mbars	
Surface Temperature	ST	K	

OK Cancel

Figure A-126. RADAR Atmospheric Screen

The Antenna Loss screen, shown in Figure A-127, incorporates data from the LOSS card.

RADAR Antenna Loss Data

Parameter	Code Varibale	Units	User Values
Antenna Ohmic Loss	**ALA**	dB	
Scanning Antenna Pattern Loss	**ALP**	dB	
Receiver Transmission Line Loss	**ALR**	dB	
Transmitter Transmission Line Loss	**ALT**	dB	
Miscellaneous Losses	**ALX**	dB	
Atmospheric Transmission Loss Factor	**ALTX**	dB/km	○ **Have Program Calculate** ○ **User Specified**

OK Cancel

Figure A-127. RADAR Antenna Loss Screen

The Target screen, shown in Figure A-128, incorporates data from the TARG card.

RADAR Target Data

Parameter	Code Variable	Units	User Values
Height Increment	**DELHT**	m	
Range Increment	**BELR**	m	
Height of Target	**HT**	m	
Range Offset	**RO**	m	
Target Cross Section	**SIG**	m	
Ground Velocity of Target	**VTGT**	km/hr	

OK Cancel

Figure A-128. RADAR Target Screen

The Dielectric screen, shown in Figure A-129, incorporates data from the DATA card.

RADAR Dielectric Data

Parameter	Code Variable	Units	User Values
Imaginary Part of Dielectric Constant of Surface	DIELI	-	
Real Part of Dielectric Constant of Surface	DIELR	-	
Number of Range Points Desired	NPTS	-	

OK Cancel

Figure A-129. RADAR Dielectric Screen

The Clutter screen, shown in Figure A-130, incorporates data from the CLU1 and CLU2 cards.

Parameter	Code Variable	Units	User Values
Radar Type	RDTYP	-	Pulse Doppler
Pulse Frequency Type	TYPRF	-	Sinusodial
Clutter Input Choice	IFSIG	-	Input Average Input Spectrum
Average Surface Clutter RCS Per Unit Area	DISG	m /m	
Average Volume Clutter RCS Per Unit Area	DNUE	m /m	
First Corner of Response Function	F1	Hz	
Second Corner of Response Function	F2	Hz	
Clutter Improvement Factor	CLTI	dB	
Probability of False Alarm Due to Clutter	PFAC	-10	
Required Signal to Clutter Ratio	SCR	dB	
Pulse Repetition Frequency	PRF	-	
Number of Poles for Filter	P	-	

OK Cancel

Figure A-130. RADAR Clutter Screen

A.16 PFNDAT

The PFNDAT Database contains data used by several EOSAEL Modules and cannot be executed. Therefore, GUI screens were not required and their creation was ignored.

A.17 Optical Path Bending (REFRAC) Module

The Optical Path Bending (REFRAC) module calculates the amount of curvature a ray of light experiences as it passes over a complex terrain surface. Figure A-131 shows the Input Menu Choices. REFRAC input screens are Terrain, Temperature Gradient, Climatology, and Beam Source screen.

REFRAC

Input Menu
Terrain → Range and Altitude Specifications
Temperature Gradient
Climatology
Beam Source

Figure A-131. REFRAC Input Menu Choices

The Terrain screen, shown in Figure A-132, incorporates data from the FLAT, STIK, FOUR, and SINE cards. The user must indicate at the top of this screen which terrain shape type to be used. Figures A-133 through A-135 show the parameters available to the user based on this choice. When either STIK or FOUR terrain type is chosen, the user must enter specifications for the terrain points. The user can access this screen, the Range and Altitude Specifications screen shown in Figure A-136, using the button made visible and active when either option is chosen. From the Range and Altitude Specifications screen, the user can Add, and Delete terrain points and the number of terrain points will be reflected on the previous screen.

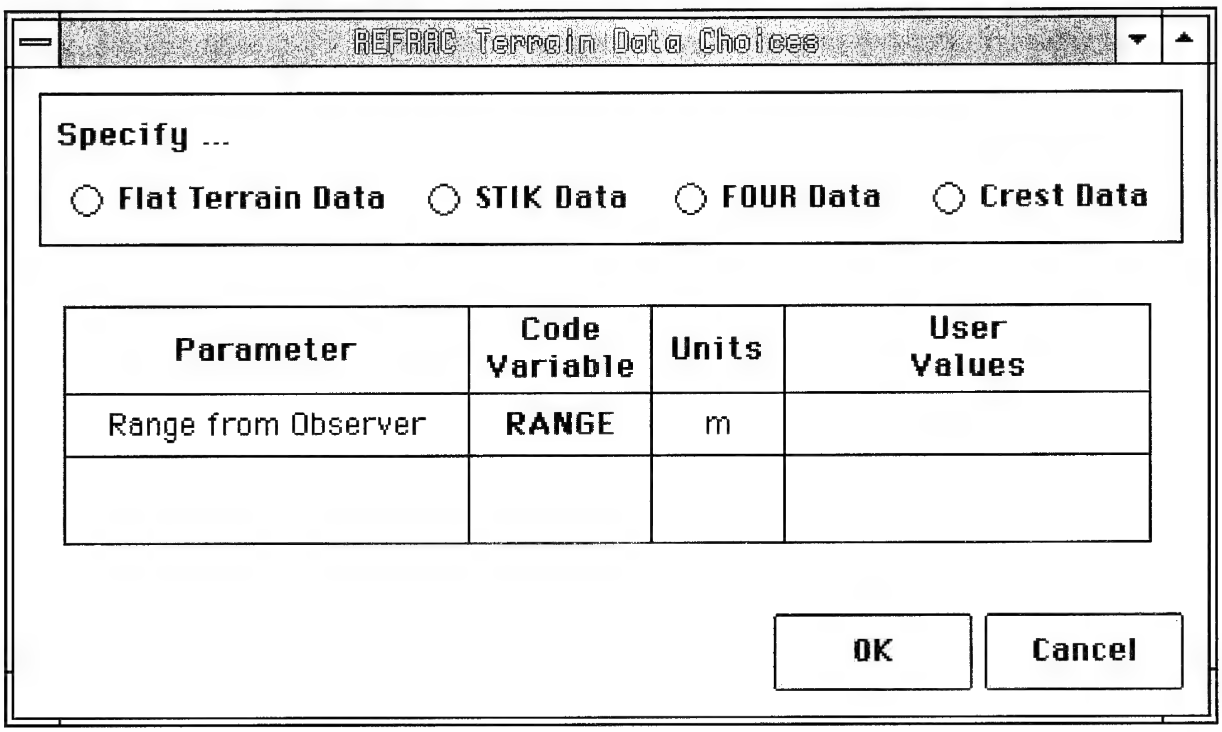


Figure A-132. REFRAC Terrain Screen, Option 1

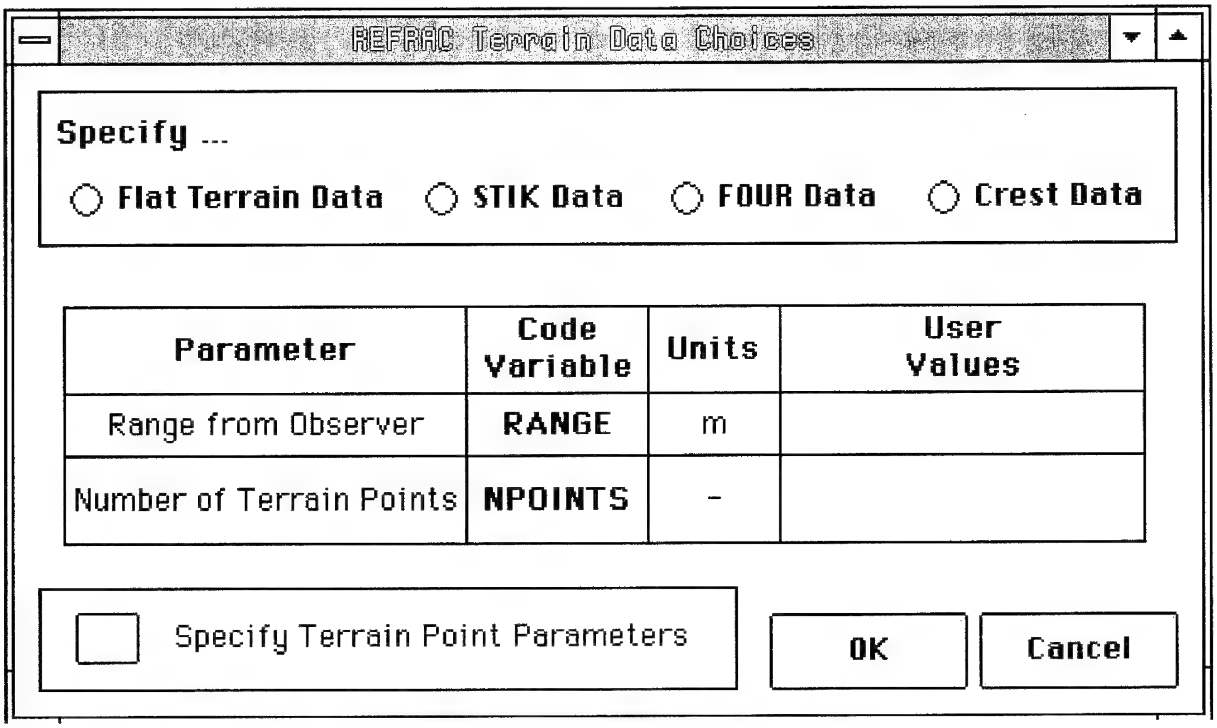


Figure A-133. REFRAC Terrain Screen, Option 2

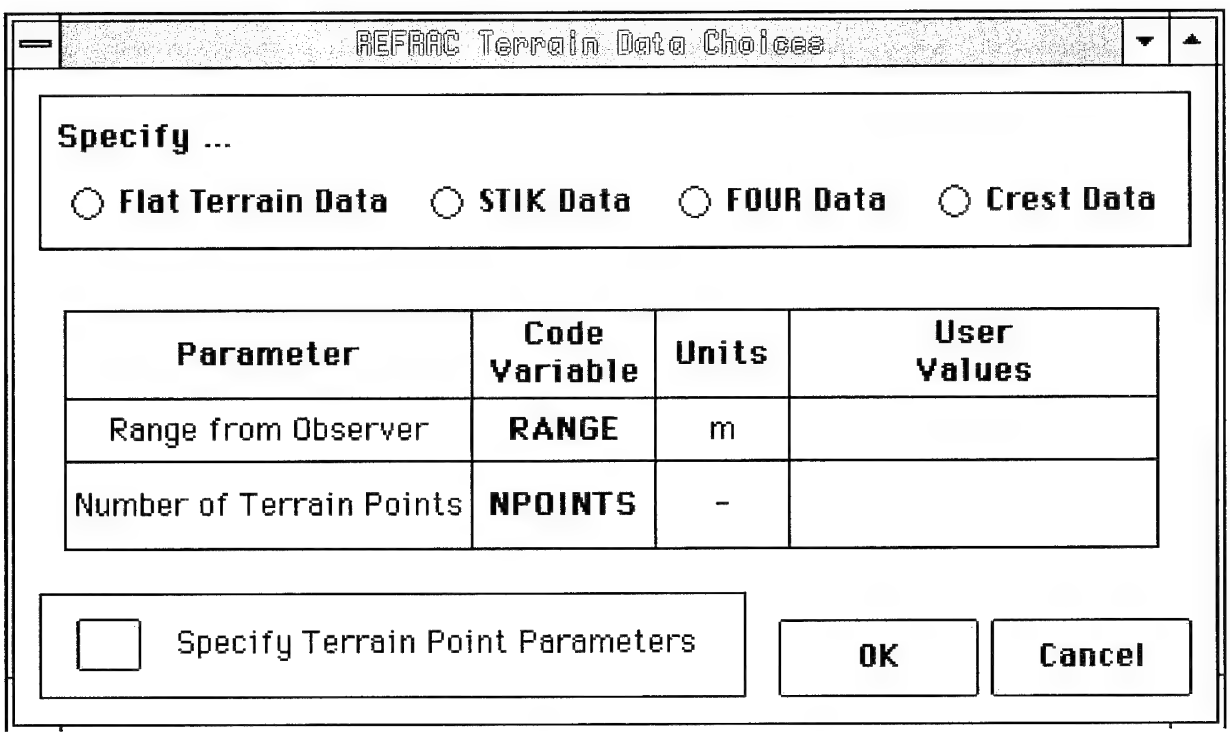
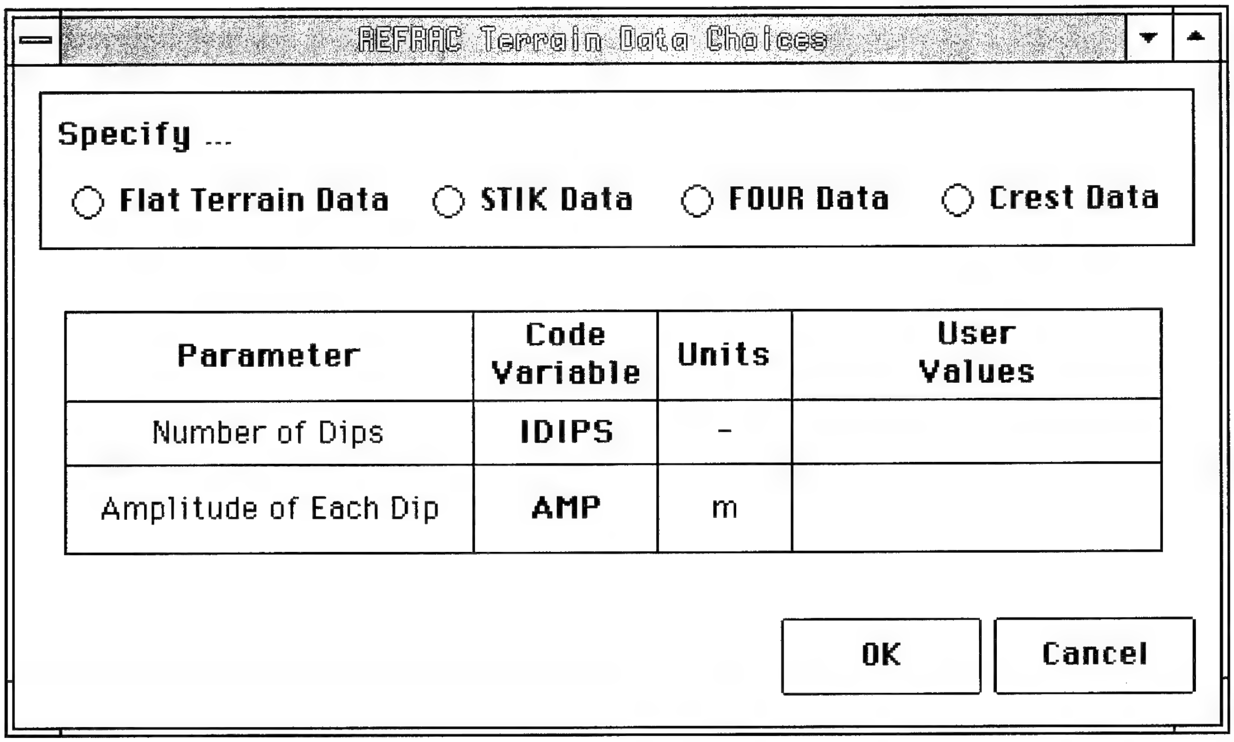


Figure A-134. REFRAC Terrain Screen, Option 3



REFRAC Terrain Data Choices

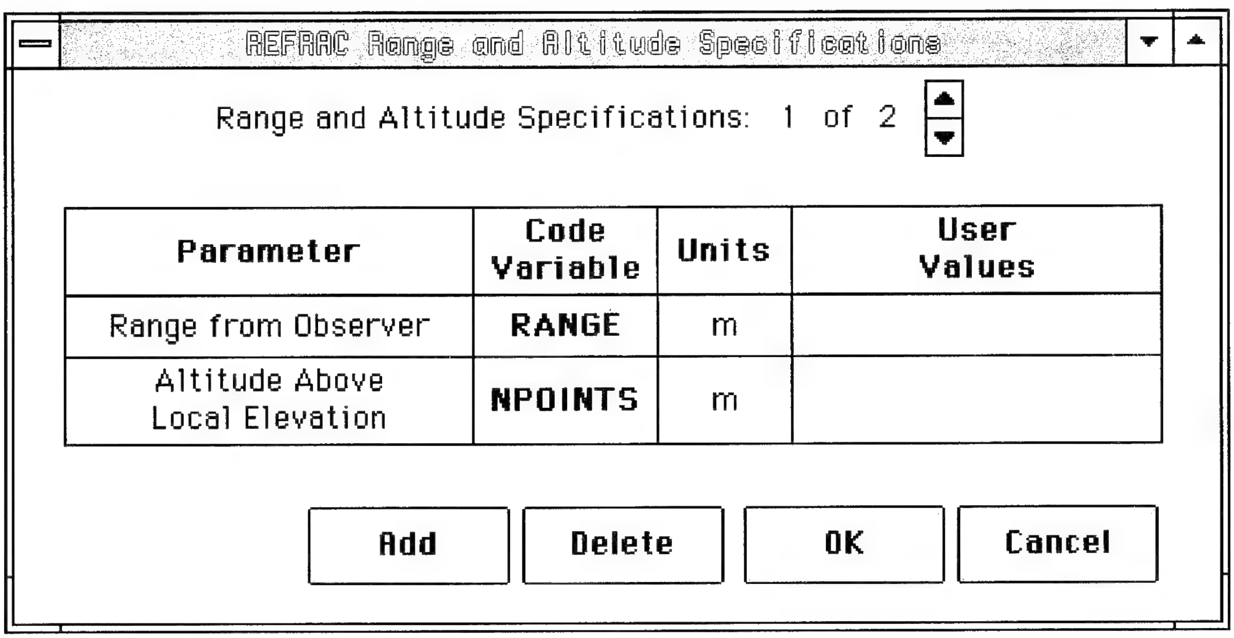
Specify ...

○ Flat Terrain Data ○ STIK Data ○ FOUR Data ○ Crest Data

Parameter	Code Variable	Units	User Values
Number of Dips	IDIPS	-	
Amplitude of Each Dip	AMP	m	

OK Cancel

Figure A-135. REFRAC Terrain Screen, Option 4



REFRAC Range and Altitude Specifications

Range and Altitude Specifications: 1 of 2

Parameter	Code Variable	Units	User Values
Range from Observer	RANGE	m	
Altitude Above Local Elevation	NPOINTS	m	

Add Delete OK Cancel

Figure A-136. REFRAC Altitude Specifications Screen

The Temperature Gradient screen, shown in Figure A-137 incorporates data from the WEBB, and SIML cards. Figure A-138 shows the choices available if the user chooses to use the Obukhov Length option.

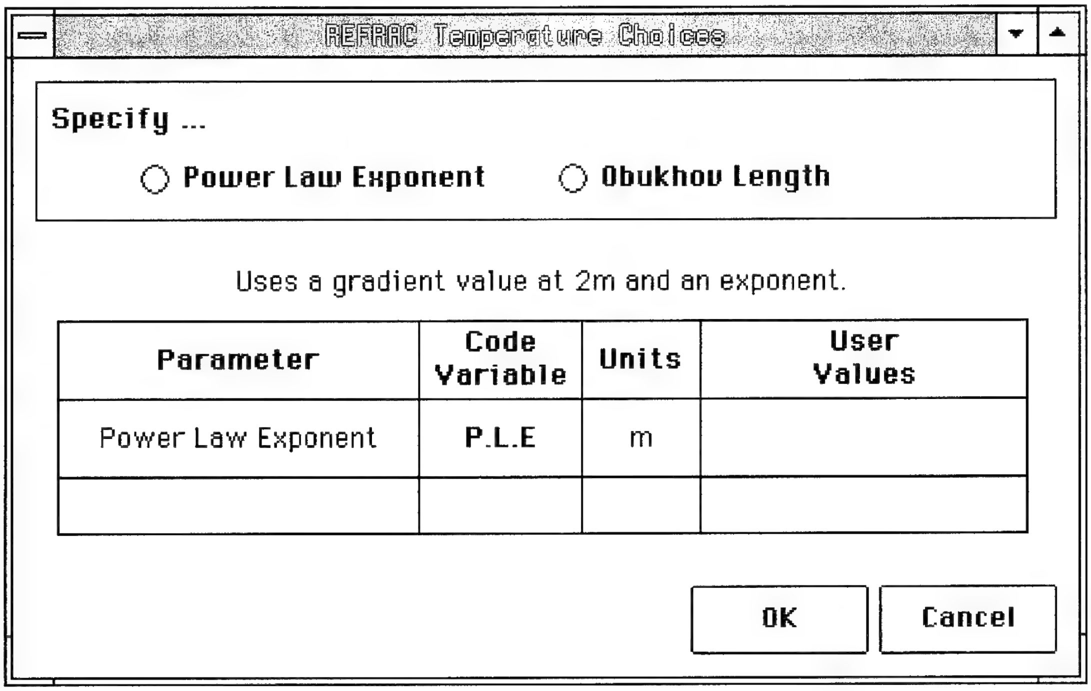


Figure A-137. REFRAC Temperature Gradient Screen

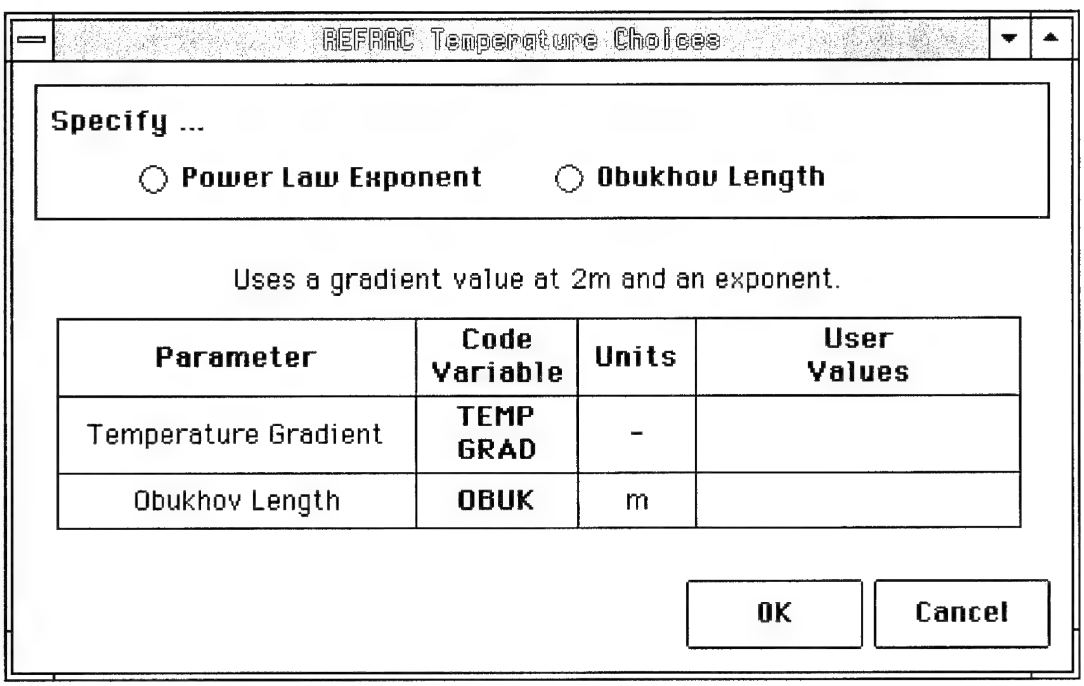


Figure A-138. REFRAC Temperature Gradient Screen

The Climatology screen, shown in Figure A-143, incorporates data from the CLIMMIDE and CLIMEURO cards. The user can choose to use the CLIMAT Module. Applicable data will become active or inactive, depending on this choice.

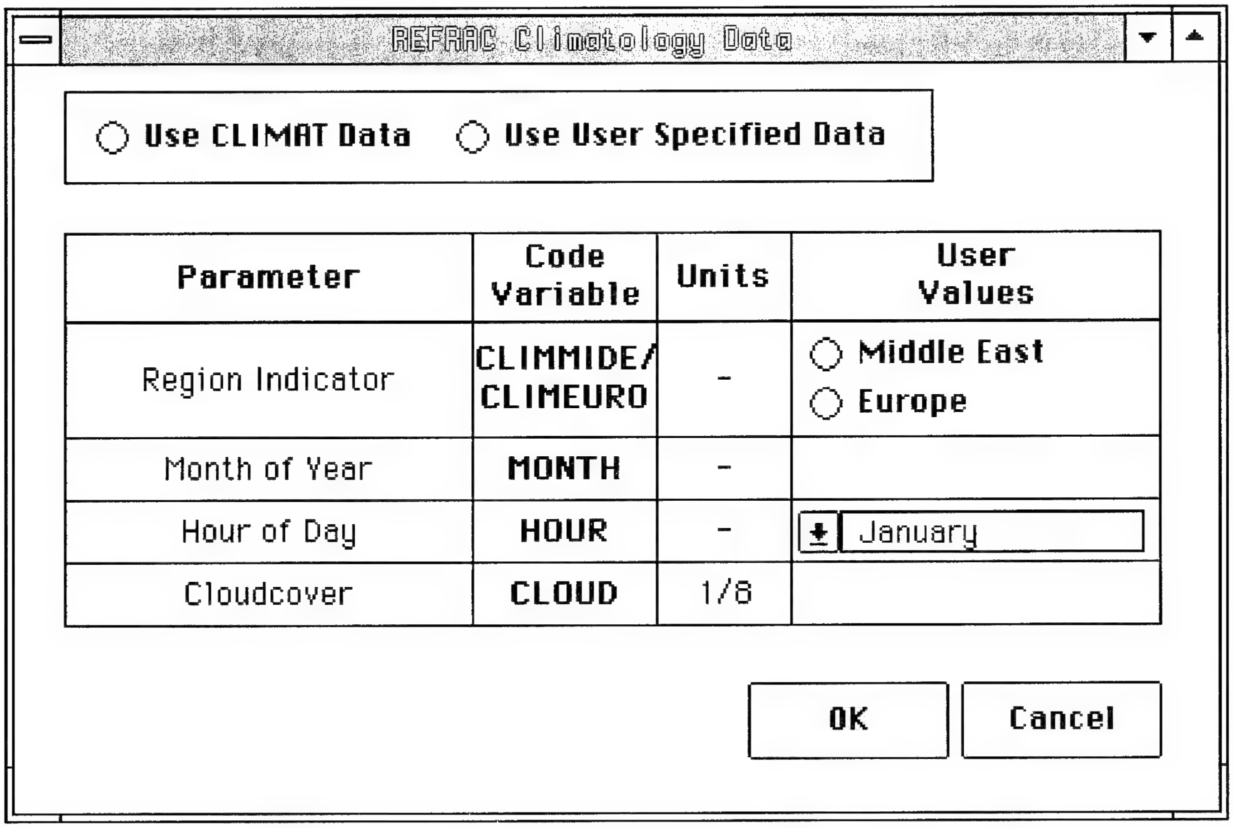


Figure A-139. REFRAC Climatology Screen

The Beam Source screen, shown in Figure A-140, incorporates data from the BEAMSPRD and BEAMHOME cards. The parameters on this screen are dependent on the choice made at the top of the screen. Applicable parameters will become active or inactive based on this choice.

○ **Use a set of beams projected at different inital angles.**

○ **Use a particular beam that will strike the target at the desired height.**

Parameter	Code Variable	Units	User Values
Transmitter Height Above Local Terrain	**BEAMSPRD**	m	
Target Height Above Local Terrain	**TARGET**	m	
Sight Elevation Above Sea Level	**HEIGHT**	m	
Boresight Elevation Angle Relative to the Normalized Surface	**ELEV**	milli-radians	
Beamspread to be Used in the Plotting Routine	**BEAMSPREAD**	milli-radians	

OK **Cancel**

Figure A-140. REFRAC Beam Source Screen

A.18 Target Acquisition (TARGAC) Module

The target acquisition (TARGAC) module predicts the atmospheric effects on the ability of EO sensors to detect and/or recognize a target. The user can specify data for multiple runs. TARGAC calls XSCALE and optionally CLIMAT, and ILUMA. TARGAC also uses FASCAT generated data. Currently FASCAT must be ran off line and the data supplied to TARGAC must be put on a special card. The implementation shown here assumes that modifications will be done to allow FASCAT to be accessed from TARGAC and lessen the load on the user. Figure A-141 shows the Input Menu Choices. TARGAC input screens are Sensor Type, Acquisition Data, Climatology Data, Sensor Coefficient, Optical Contrast, Geometry Screen, Target Thermal Signature, High Cloud, Middle Cloud, Low Cloud, Subjective Resolution Curve Definition, Illumination, Meteorological, Contrast Tranmittance, Thermal Contrast Model, Abscissa and Ordinate Point Pairs, Site, Smoke, Sound, Target, and Extinction and Humidity.

TARGAC

Input Menu
Sensor Type
Acquisition Data
Climatology Data
Sensor Coefficient
Optical Contrast
Geometry Screen
Target Thermal Signature
High Cloud
Middle Cloud
Low Cloud
Subjective Resolution Curve Definition
Illumination
Meteorological
Contract Transmittance
Thermal Contrast Model
Abscissa and Ordinate Point Pairs
Site
Smoke
Sound
Target
Extinction and Humidity

Figure A-141. TARGAC Input Menu Choices

The Sensor Type screen, shown in Figure A-142, incorporates data from the TAC.DAT file. Most other input screens are dependent on this choice. Certain screen are invalid or required based on the selection of the Sensor Type. After the Sensor Type has been defined, the appropriate screens will then be available through the Input Menu. Invalid screens will be grayed out on the Input Menu List.

Sensor Type

Parameter	Code Variable	Units	Typical Values	User Values
Sensor Type	-	-	-	○ Direct View Optics ○ Image Intensifier ○ Silicon Television ○ Thermal Imager ○ User Defined

OK Cancel

Figure A-142. TARGAC Sensor Type Screen

The Acquisition Data screen, shown in Figure A-143, incorporates data from the AQUI card. The number of probabilities of performance can either be entered in the first parameter or determined by the number specified on this screen. The defaults are shown and the data on this screen are required.

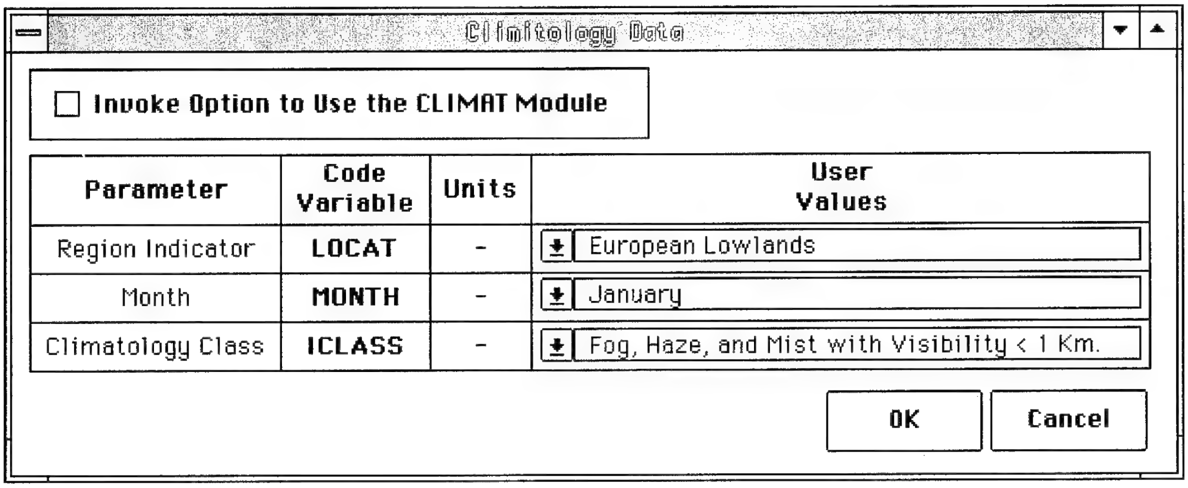
Acquisition Data

Parameter	Code Variable	Units	Typical Values	User Values
Number of Probabilities	NPROB	-	1, 2, or 3	○ One ○ Two ○ Three
Probabilities of Performance	PF(1)	-	0.10 - 0.90	0.25
	PF(2)	-		0.50
	PF(3)	-		0.75
Minimum Target Dimension	DIM	m	0.2 - 50.0	2.4

OK Cancel

Figure A-143. TARGAC Acquisition Data Screen

The Climatology Data screen, shown in Figure A-144, incorporates data from the CLIM card. These data are optional and only needs to be present if the user chooses to use the CLIMAT module.


Climitology Data

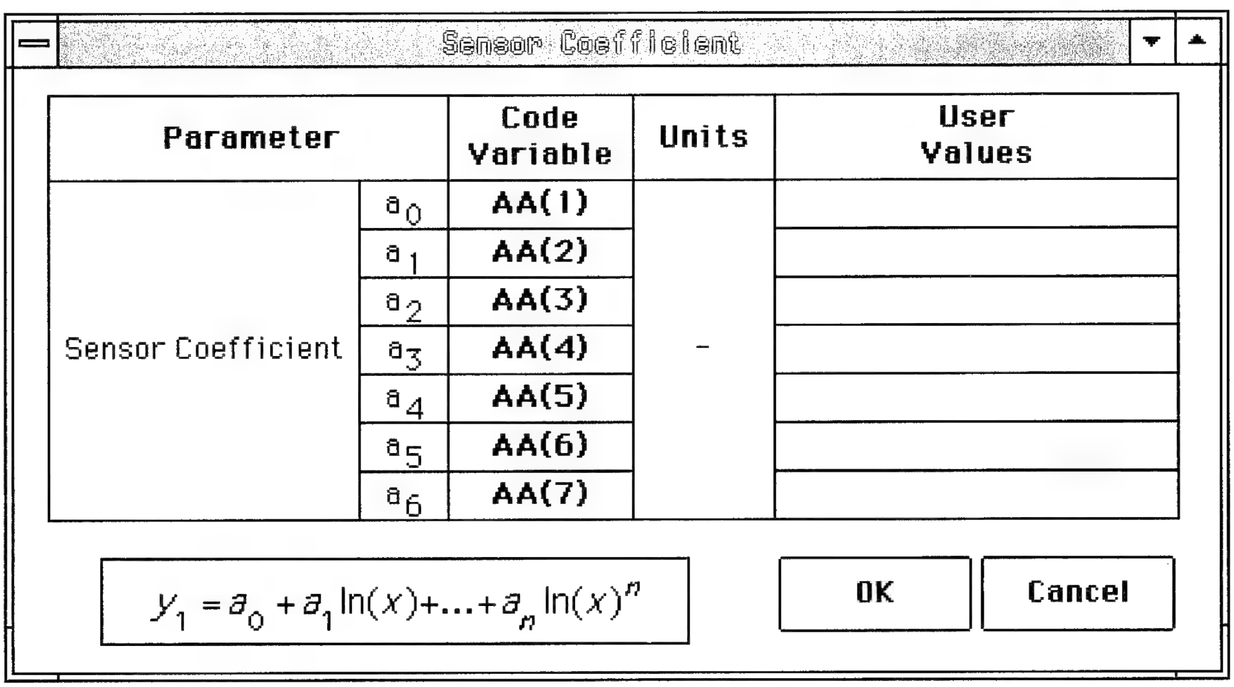
☐ Invoke Option to Use the CLIMAT Module

Parameter	Code Variable	Units	User Values
Region Indicator	LOCAT	-	European Lowlands
Month	MONTH	-	January
Climatology Class	ICLASS	-	Fog, Haze, and Mist with Visibility < 1 Km.

OK Cancel

Figure A-144. TARGAC Climatology Data Screen

The Sensor Coefficient screen, shown in Figure A-145, incorporates data from the COEF card. These data only need to be present if the user chooses the User Defined Sensor on the Sensor Type screen and the Type of Input for the Subjective Resolution Curve parameter on the Subjective Resolution Curve Definition screen is set to Coefficient. This screen will be available through the Input Menu only when applicable.


Sensor Coefficient

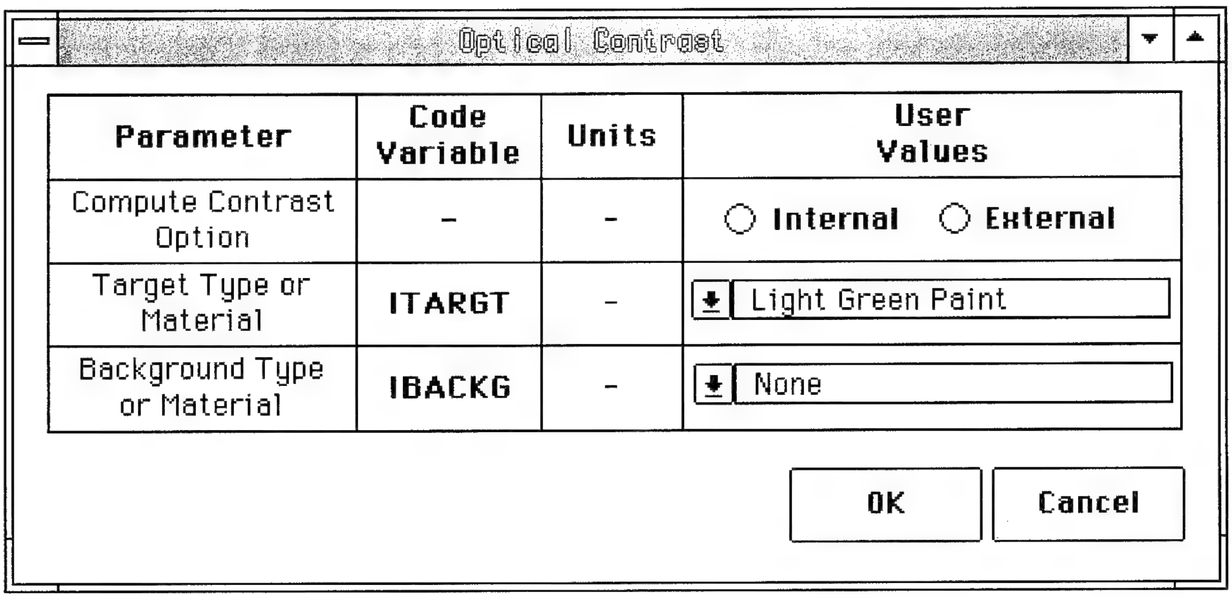
Parameter		Code Variable	Units	User Values
Sensor Coefficient	a_0	AA(1)	-	
	a_1	AA(2)		
	a_2	AA(3)		
	a_3	AA(4)		
	a_4	AA(5)		
	a_5	AA(6)		
	a_6	AA(7)		

$$y_1 = a_0 + a_1 \ln(x) + \ldots + a_n \ln(x)^n$$

OK Cancel

Figure A-145. TARGAC Sensor Coefficient Screen

The Optical Contrast screen, shown in Figure 146, incorporates data from the CONT card. This card is required. The user must specify whether to use Internal or External calculation method for the contrast. If Internal is chosen the variable on this screen are active and values must be chosen. The defaults are shown. If the user chooses the external option, he will then specify which module to use in order to determine the contrast. Currently the user calculates the contrast off-line and then enters this value. The option to do this calculation on-line will be added in Phase II of this project.



Optical Contrast

Parameter	Code Variable	Units	User Values
Compute Contrast Option	-	-	○ Internal ○ External
Target Type or Material	ITARGT	-	Light Green Paint
Background Type or Material	IBACKG	-	None

OK Cancel

Figure A-146. TARGAC Optical Contrast Screen

The Geometry screen, shown in Figure A-147, incorporates data from the GEOM card. These data are required.

Geometry

Parameter	Code Variable	Units	Typical Values	User Values
Julian Date	**DATE**	-	1 - 366	188
Zulu Time	**TIME**	HHMM	0000 - 2400	12 00
Latitude	**ALAT**	-	-90 - 90	55.0
Longitude	**ALONG**	-	-180 - 180	55.0
Target Azimuth	**TARGAZ**	degrees	0 - 360	55.0
Year	**YEAR**	yr	1977 - 1999	1989

OK Cancel

Figure A-147. TARGAC Geometry Screen

The Target Thermal Signature screen, shown in Figure A-148, incorporates data from the GNRC card. These data are required only when the Sensor Type defined on the Sensor Type screen is defined to be a Thermal Imager. This screen will be available through the Input Menu only when applicable. Defaults are not specified for this screen.

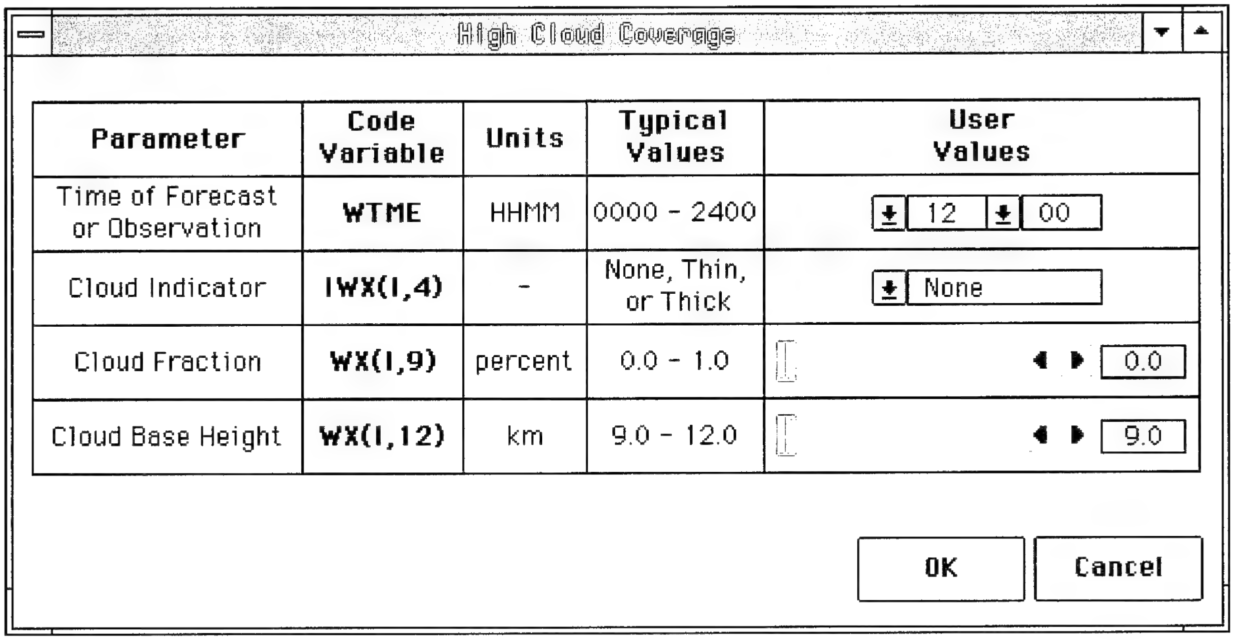
Target Thermal Contrast

Parameter	Code Variable	Units	Typical Values	User Values
Target Temperature	**ALAT**	K	280 - 320	
Background Temperature	**ALONG**	K	280 - 320	
Length of Effective X-dimension	**TARGAZ**	m	0.5 - 20.0	
Length of Effective Y-dimension	**TARGAZ**	m	0.5 - 20.0	

OK Cancel

Figure A-148. TARGAC Target Thermal Signature Screen

The High, Middle and Low Cloud screens, shown in Figures A-149 through A- 151, incorporate data from the HCLD, MCLD, and LCLD cards. These data are only required when the Sensor Type defined on the Sensor Type screen is defined to be a Thermal Imager. These screens will be available through the Input Menu only when applicable. Default values are shown.

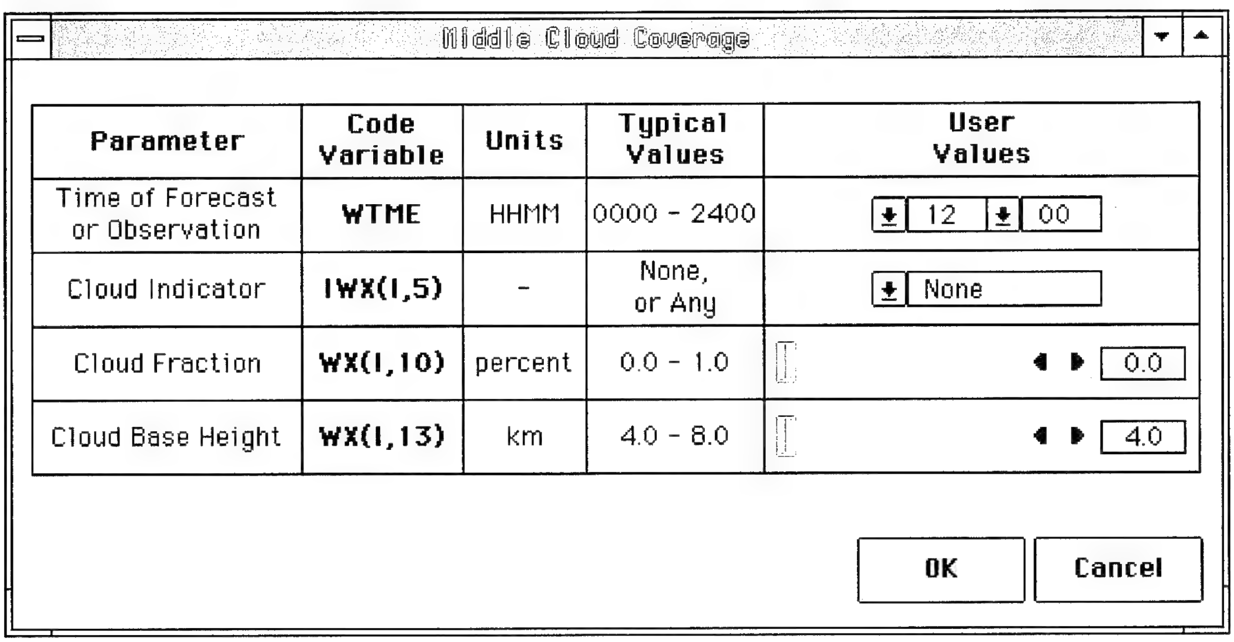


High Cloud Coverage

Parameter	Code Variable	Units	Typical Values	User Values
Time of Forecast or Observation	WTME	HHMM	0000 - 2400	12 00
Cloud Indicator	IWX(I,4)	-	None, Thin, or Thick	None
Cloud Fraction	WX(I,9)	percent	0.0 - 1.0	0.0
Cloud Base Height	WX(I,12)	km	9.0 - 12.0	9.0

OK Cancel

Figure A-149. TARGAC High Cloud Screen



Middle Cloud Coverage

Parameter	Code Variable	Units	Typical Values	User Values
Time of Forecast or Observation	WTME	HHMM	0000 - 2400	12 00
Cloud Indicator	IWX(I,5)	-	None, or Any	None
Cloud Fraction	WX(I,10)	percent	0.0 - 1.0	0.0
Cloud Base Height	WX(I,13)	km	4.0 - 8.0	4.0

OK Cancel

Figure A-150. TARGAC Middle Cloud Screen

Low Cloud Coverage

Parameter	Code Variable	Units	Typical Values	User Values
Time of Forecast or Observation	WTME	HHMM	0000 - 2400	12 00
Cloud Indicator	IWX(I,4)	-	None, Stratus, or Convective	None
Cloud Fraction	WX(I,9)	percent	0.0 - 1.0	0.0
Cloud Base Height	WX(I,12)	km	1.0 - 4.0	1.0

OK Cancel

Figure A-151. TARGAC Low Cloud Screen

The Subjective Resolution Curve Definition screen, shown in Figure A-152, incorporates data from the IFUN card. These data are only required when the Sensor Type defined on the Sensor Type screen is defined to be User Defined. This screen will be available through the Input Menu only when applicable.

Subjective Resolution Curve Definition

Parameter	Code Variable	Units	User Values
Type of Input for the Subjective Resolution Curve	IFUN	-	Coefficients
General Device Type	IDEV	-	Direct View Optics
Magnifiction	AAMAG	-	1.0
Contrast Limit	CLIM	-	0.2

OK Cancel

Figure A-152. TARGAC Subjective Resolution Curve Definition Screen

The Illumination screen, shown in Figure A-153, incorporates data from the ILUM card. These data are only required when the Sensor Type defined on the Sensor Type screen is defined to be either, Direct View Optics, Image Intensifier, or Silicon Television. This screen will be available through the Input Menu only when applicable. The user has the option to have ILUMA calculate the illumination level or have the user specify the needed data. Base on this choice, the screen will display the required data parameters. When the External option is chosen, the user must enter the parameters 2-5 or parameter 6 in Figure A-153.

Illumination

Parameter	Code Variable	Units	User Values
Compute Illumination Option	-	-	○ Internal ○ External
Illuminance	AL	fc	1000.0
Significant Weather	SIGWX	-	Sky Cover < 50%
State of Ground	OBSURF	fc	Dry
Precipitation Type	PRTYPE	-	None
Moon Phase	IMOON	-	Full

OK Cancel

Figure A-153. TARGAC Illumination Screen

The Meteorological screen, shown in Figure A-154, incorporates data from the META, and METB cards and some data from the TIME card. Data is required for at least 3 time intervals at or before the time of interest. The user may add or delete screens by using the Add and Delete buttons. The Number of Data Sets (NTIM) found on the TIME card is calculated internally based on the number of defined sets. The user can move from screen to screen using the arrows at the top of the screen. Parameters that are no longer used by the model have been left off. The Clutter parameter, which currently is not being used is shown under the speculation that this will be included in later versions as the document indicates.

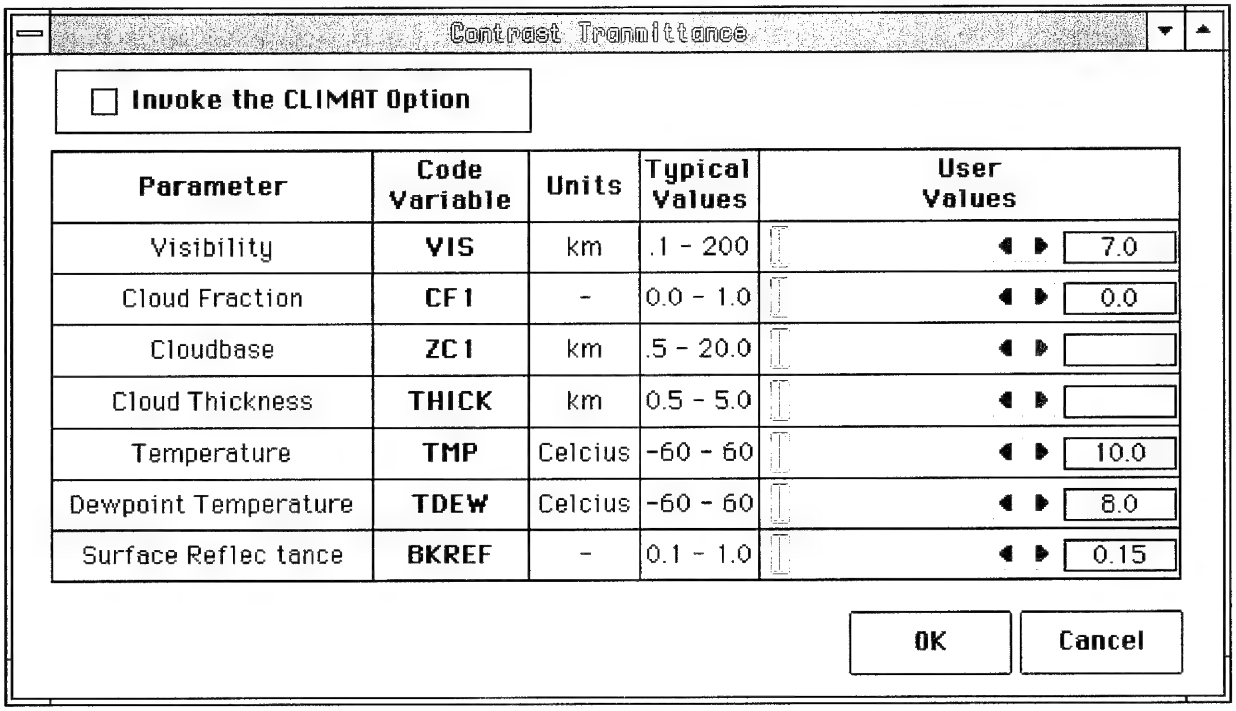
Meteorological Data: 1 of 3

Parameter	Code Variable	Units	Typical Values	User Values
Time of Observation	WTME	HHMM	0000 - 2400	(•) Day of Event ( ) Day Before Event ( ) Two Days Before Event 0000
Weather Index	IWX(I,1)	-	-	Sky Cover < 50%
Inversion Height	WX(I,15)	km	0.0 - 8.0	3.0
Wind Direction	WX(I,18)	degrees	1 - 360	270
Temperature	WX(I,3)	Celcius	-60 - 60	10.0
Dew Point Temperature	WX(I,4)	Celcius	-60 - 60	8.0
Windspeed	WX(I,5)	knots	0 - 70	8.0
Visibility	WX(I,6)	-	.1 - 200	10.0
Clutter	IWX(I,8)	-	-	Low

Add Delete OK Cancel

Figure A-154. TARGAC Meteorological Screen

The Contrast Tranmittance screen, shown in Figure A-155, incorporates data from the METD card. These data are only required when the Sensor Type defined on the Sensor Type screen is defined to be either, Direct View Optics, Image Intensifier, or Silicon Television. This screen will be available through the Input Menu only when applicable. If the user chooses to use the CLIMAT module, data from the CLIMAT module will supersede data defined here. Effected parameters will be inactive. Data from this card are used when calling XSCALE.



Parameter	Code Variable	Units	Typical Values	User Values
Visibility	VIS	km	.1 - 200	7.0
Cloud Fraction	CF1	-	0.0 - 1.0	0.0
Cloudbase	ZC1	km	.5 - 20.0	
Cloud Thickness	THICK	km	0.5 - 5.0	
Temperature	TMP	Celcius	-60 - 60	10.0
Dewpoint Temperature	TDEW	Celcius	-60 - 60	8.0
Surface Reflec tance	BKREF	-	0.1 - 1.0	0.15

Figure A-155. TARGAC Contrast Transmittance Screen

The Thermal Contrast Model screen, shown in Figure A-156, incorporates data from the NRUN card, and some data from the TIME card. These data are required only when the Sensor Type defined on the Sensor Type screen is defined to be a Thermal Imager. The Number of Thermal Contrast Model Runs (NRUNTM), found on the TIME card, is calculated internally by the number of defined output times.

Parameter	Code Variable	Units	Typical Values	User Values	
Thermal Contrast Output Time (Relative to the Time of Interest)	TRLTOT(1)	HHMM	-3000 - 0000	00	00
	TRLTOT(2)			00	00
	TRLTOT(3)			00	00
	TRLTOT(4)			00	00
	TRLTOT(5)			00	00
	TRLTOT(6)			00	00
	TRLTOT(7)			00	00
	TRLTOT(8)			00	00
	TRLTOT(9)			00	00
	TRLTOT(10)			00	00

OK Cancel

Figure A-156. TARGAC Thermal Contract Model Screen

The Abscissa and Ordinate Point Pairs screen, shown in Figure A-157, incorporates data from the POIN card. These data are optional and only needs to be present if the user chooses the User Defined Sensor on the Sensor Type screen and the Type of Input for the Subjective Resolution Curve parameter on the Subjective Resolution Curve Definition screen is set to Pairs of Points. This screen will be available through the Input Menu only when applicable.

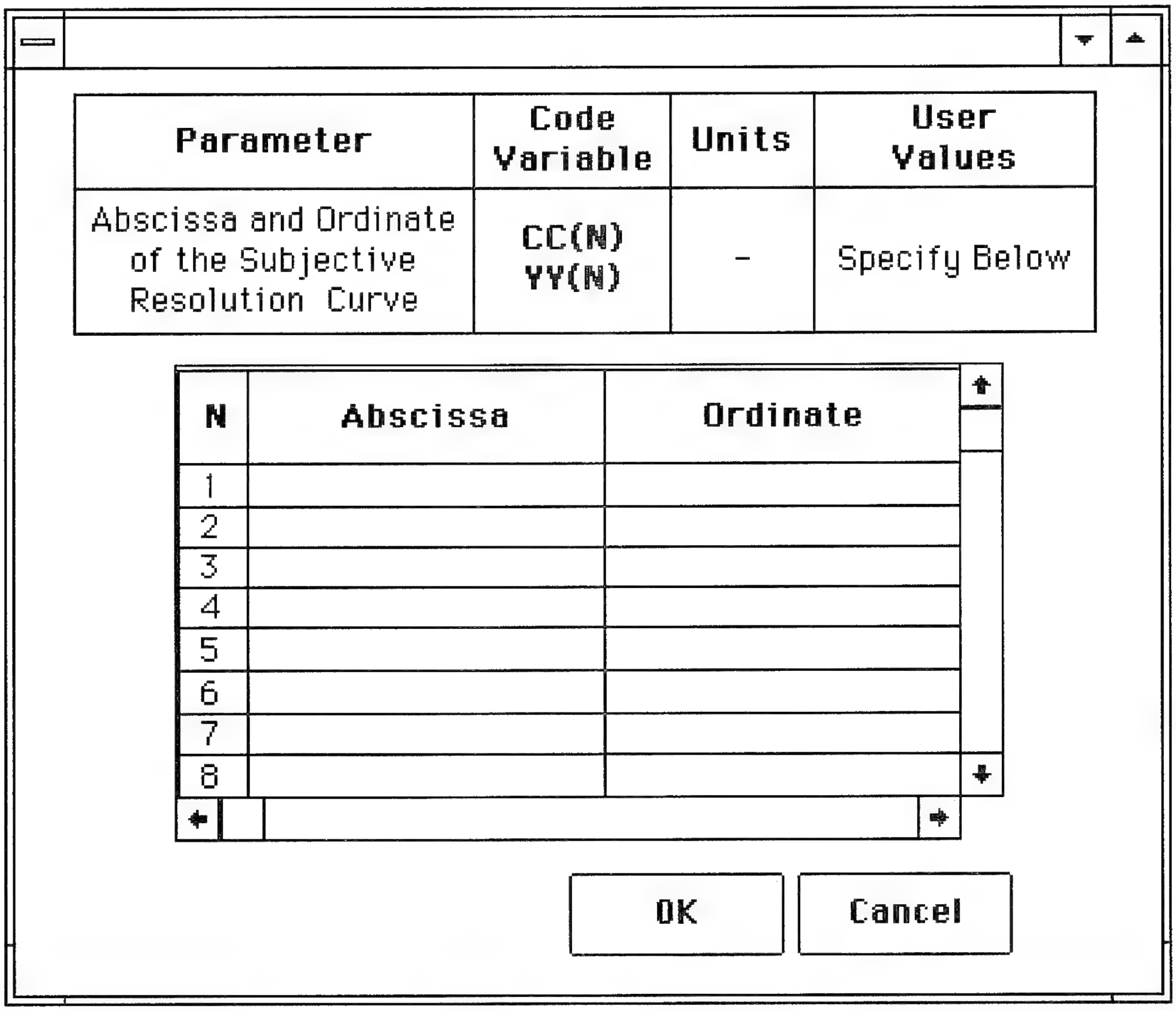


Figure A-157. TARGAC Abscissa and Ordinate Point Pairs Screen

The Site screen, shown in Figure A-158, incorporates data from the SITE card. These data are required only when the Sensor Type defined on the Sensor Type screen is defined to be a Thermal Imager. This screen will be available through the Input Menu only when applicable. Defaults for this screen are shown.

Site

Parameter	Code Variable	Units	Typical Values	User Values
Latitude	RLATT	degrees	-90 - 90	55
Longitude	RLONG	degrees	-180 - 180	-9
Julian Day	IDATE	-	1 - 366	188
Time of Interest	ITIMOT	HHMM	0000 - 2400	12 00
Elevation	ELEV	ft	-1300 - 30000	1000
Average Temperature	TBAR	Celcius	-60 - 60	10
Surface Albedo	ALB	-	0.0 - 1.0	0.15

OK Cancel

Figure A-158. TARGAC Site Screen

The Smoke screen, shown in Figure A-159, incorporates data from the SMOK card. Data on this card are optional.

Smoke

Parameter	Code Variable	Units	User Values
Smoke Screen Type	ISMYPE	-	Large Area Smoke Screen or Fog Oil
Amount of Smoke	ISMUCH	-	Light
Smoke Screening Degree	IPH	-	Light
Amount of High Explosive	IHE	-	Light
Distance from Detector to Screen	SMANGE	km	3.0
Distance for Line Of Sight Through the Screen	SMEL	m	200

OK Cancel

Figure A-159. TARGAC Smoke Screen

The Sound screen, shown in Figure A-160, incorporates data from the SOND card. These data are applicable only when the Sensor Type defined on the Sensor Type screen is defined to be a Thermal Imager. This screen will be available through the Input Menu only when applicable.

Sound

○ Use File for Sound Data ○ Enter Pressure

Parameter	Code Variable	Units	Typical Values	User Values
Sound File name	NMSND	-	-	
Pressure	PRES	-	-	

OK Cancel

Figure A-160. TARGAC Sound Screen

The Target screen, shown in Figure A-161, incorporates data from the TARG card. These data are applicable only when the Sensor Type defined on the Sensor Type screen is defined to be a Thermal Imager. This screen will be available through the Input Menu only when applicable.

Target

Parameter	Code Variable	Units	Typical Values	User Values
Target Type and State	NTARID	-	-	T-62 Tank -- Off
Background Type and State	ISMUCH	-	-	Tall Grass -- Growing
Vehicle Speed	IPH	m/s	1.0 - 25.0	5.0
Aspect Angle	IHE	-	0.0 - 90.0	0.0
Sensor Altitude	SMANGE	m	0 - 10000	100
Year	SMEL	-	1977 - 1999	1991
Target Heading	SMEL	degrees	1 - 360	90

OK Cancel

Figure A-161. TARGAC Target Screen

The Extinction and Humidity screen, shown in Figure A-162, incorporates data from the XSCL card. These data are required. This screen supplies the data necessary to call XSCALE, which is used to supply the extinction and humidity profiles in the lowest layers of the atmosphere. Data defaults are given.

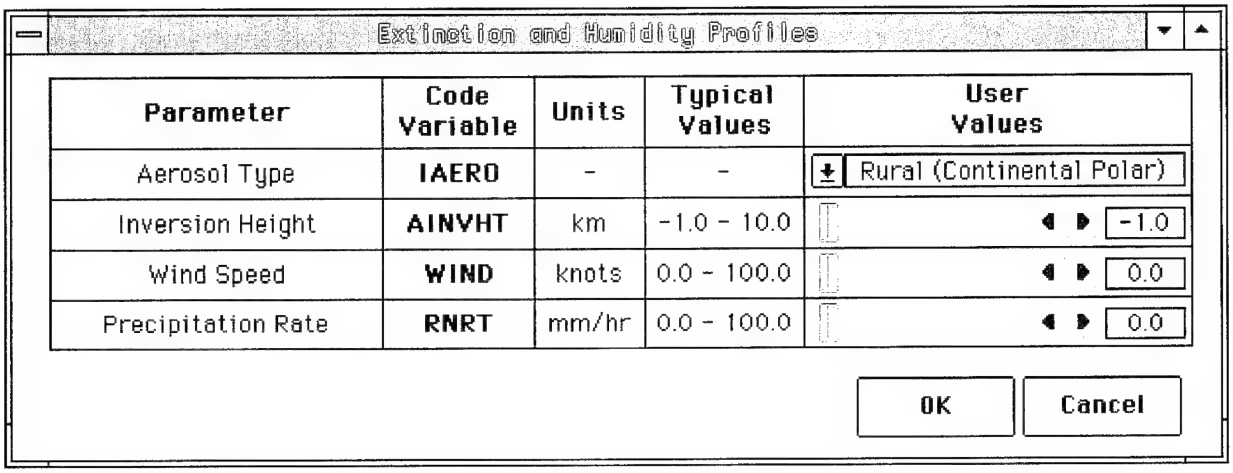


Figure A-162. TARGAC Extinction and Humidity Screen

A.19 Ultraviolet Transmission and Lidar Simulation (UVTRAN) Module

The Ultraviolet Transmission and Lidar Simulation (UVTRAN) module is an atmospheric transmission and lidar return calculation module for visible and ultraviolet wavelengths. The UVTRAN documentation did not give variable names. As a consequence, no variable names are given in the following example screens buts the place for those names as been preserved. The UVTRAN documentation did not indicate card requirement. Figure A-163 shows the Input Menu Choices. UVTRAN input screens are Ozone Concentrations, Trace Gas Concentrations, Altitude of Receiver and Visibility Measurement, Aerosol Attenuation Profile, Path, Transmission, Lidar, Mie Lidar Calculations, Fluorescence Lidar Calculation, Fluorescence Range and Concentration, and Lidar System Modifications.

UVTRAN

<u>Input Menu</u>
Ozone Concentrations
Trace Gas Concentrations
Altitude of Receiver and Visibility Measurement
Aerosol Attenuation Profile
Path
Transmission
Lidar
Mie Lidar Calculation
Fluorescence Lidar Calculation
Fluorescence Range and Concentration
Lidar System Modifications

Figure A-163. UVTRAN Input Menu Choices

The Ozone Concentrations screen, shown in Figure A-164, incorporates data from the OZON card.

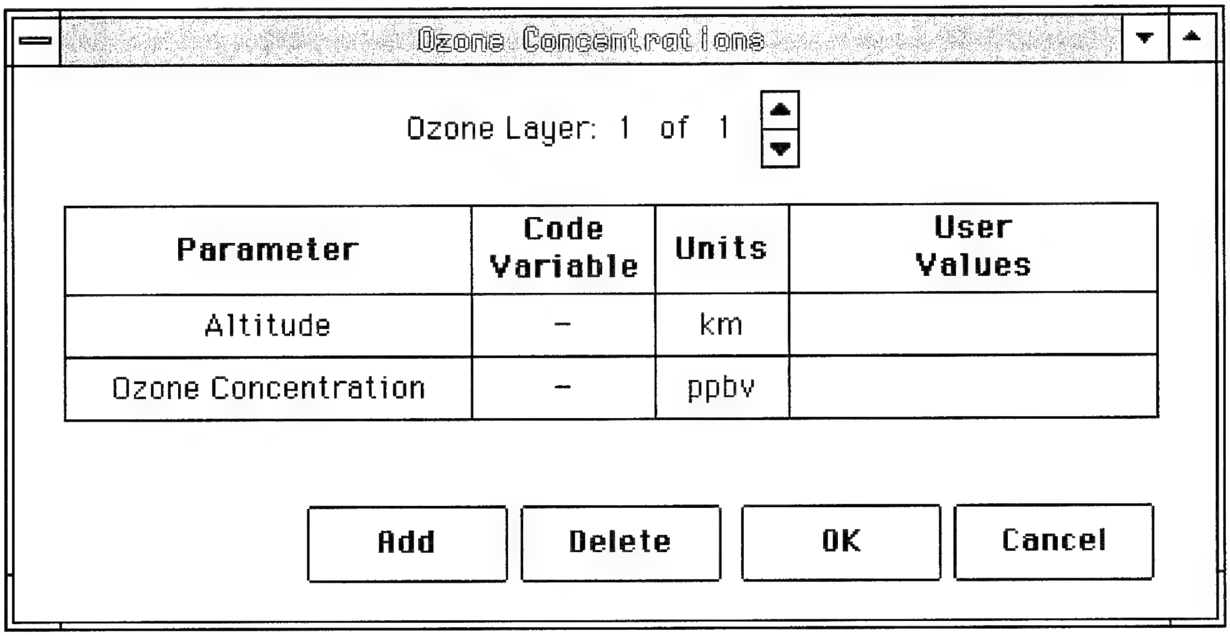


Figure A-164. UVTRAN Ozone Concentrations Screen

The Trace Gas Concentrations screen, shown in Figure A-165, incorporates data from the TGAS card.

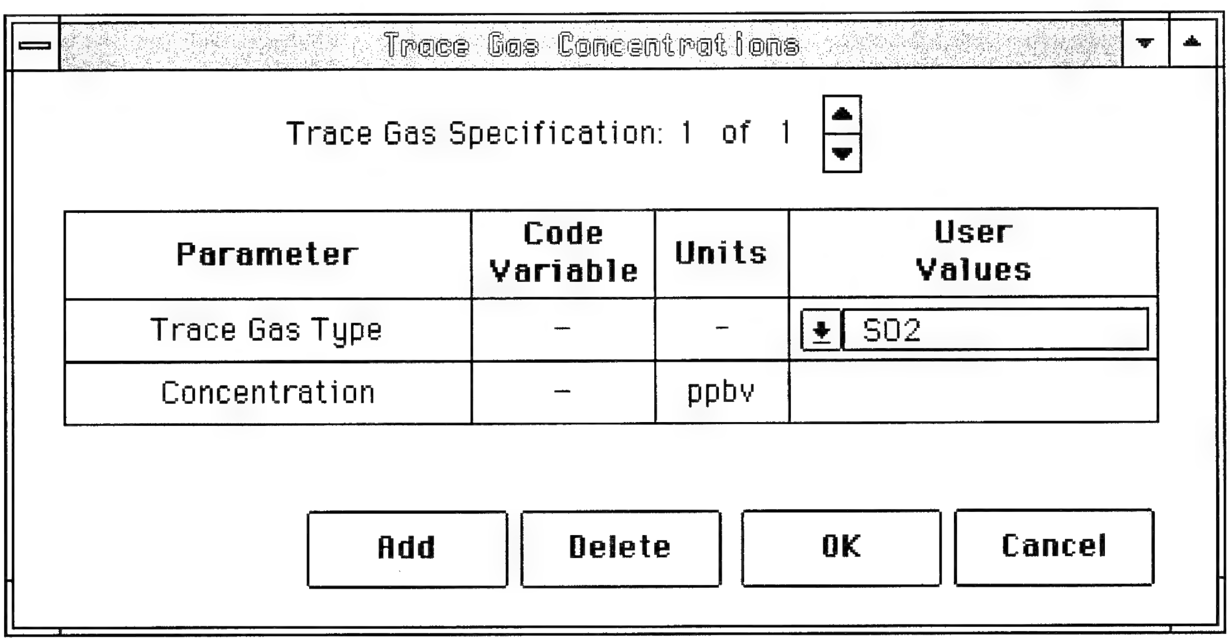


Figure A-165. UVTRAN Trace Gas Concentrations Screen

The Altitude of Receiver and Visibility Measurement screen, shown in Figure A-166, incorporates data from the ALT card.

Altitude of Receiver and Visibility Measurement

Parameter	Code Variable	Units	User Values
Receiver Altitude	-	km	
Altitude of the Visibility Measurement	-	ppbv	

OK Cancel

Figure A-166. UVTRAN Altitude of Receiver and Visibility Measurement Screen

The Aerosol Attenuation Profile screen, shown in Figure A-167, incorporates data from the AERO card. Second and third variables on this screen are inactive or active depending on the choice of the first variable.

Aerosol Attenuation Profile

Parameter	Code Variable	Units	User Values
Aerosol Attenuation Assumption	-	-	○ Constant with Height ○ Increase with Height by a Factor of X Percent per Y Meters. ○ Decrease with Height by a Factor of X Percent per Y Meters.
Percent Change	X	percent	0 100
Vertical Distance	Y	m	

OK Cancel

Figure A-167. UVTRAN Aerosol Attenuation Profile Screen

The Path screen, shown in Figure A-168, incorporates data from the PATH card. The second on this screen is dependent on the first variable. Figure A-169 shows another variation of this screen.

Path

Parameter	Code Variable	Units	User Values
Path Type	–	-	Slant
Zenith Angle	–	degrees	

OK Cancel

Figure A-168. UVTRAN Path Screen, Option 1

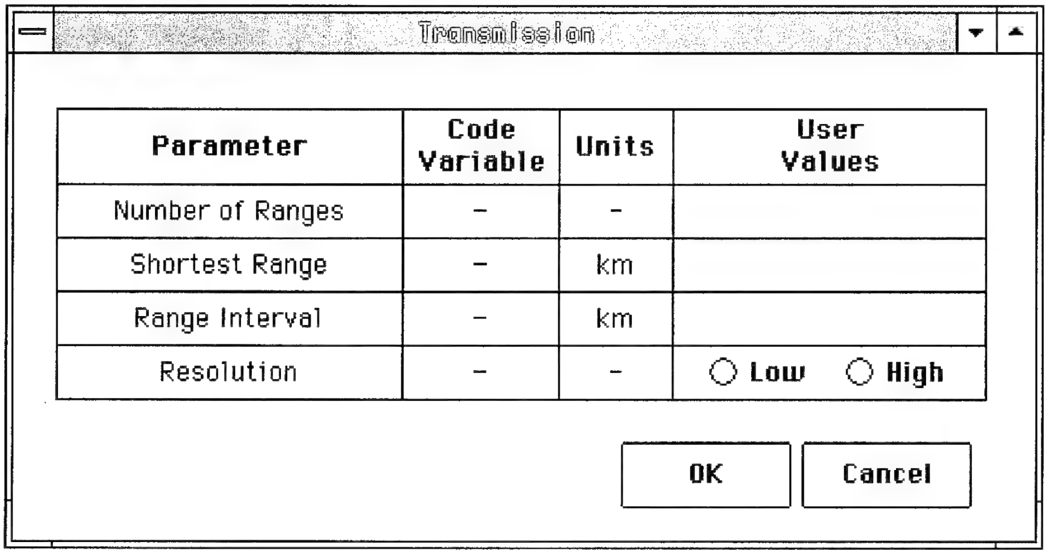
Path

Parameter	Code Variable	Units	User Values
Path Type	–	-	Horizontal
Looking Direction	–	-	Upward

OK Cancel

Figure A-169. UVTRAN Path Screen, Option 2

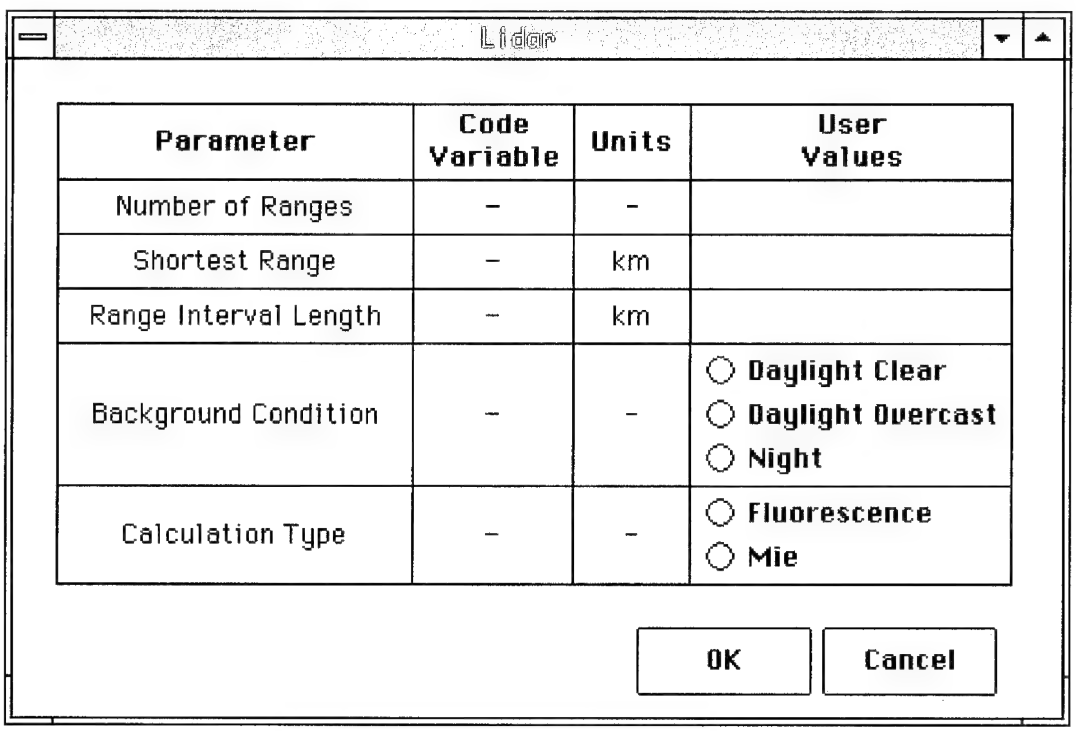
The Transmission screen, shown in Figure A-170, incorporates data from the TRAN card.



Parameter	Code Variable	Units	User Values
Number of Ranges	–	-	
Shortest Range	–	km	
Range Interval	–	km	
Resolution	–	-	○ Low ○ High

Figure A-170. UVTRAN Transmission Screen

The Lidar screen, shown in Figure A-171, incorporates data from the LIDR card. Based on the fifth variable on this screen, one of two other screen will be come accessible through the input menu. They are the Mie Lidar Calculation screen and the Fluorescence Lidar Calculation screen.



Parameter	Code Variable	Units	User Values
Number of Ranges	–	-	
Shortest Range	–	km	
Range Interval Length	–	km	
Background Condition	–	-	○ Daylight Clear ○ Daylight Overcast ○ Night
Calculation Type	–	-	○ Fluorescence ○ Mie

Figure A-171. UVTRAN Lidar Screen

The Mie Lidar Calculation screen, shown in Figure A-172, incorporates data from the MLID card. The first variables choices will be based on the values of the Lidar screen. Each range interval will be accessible through a dynamically created list.

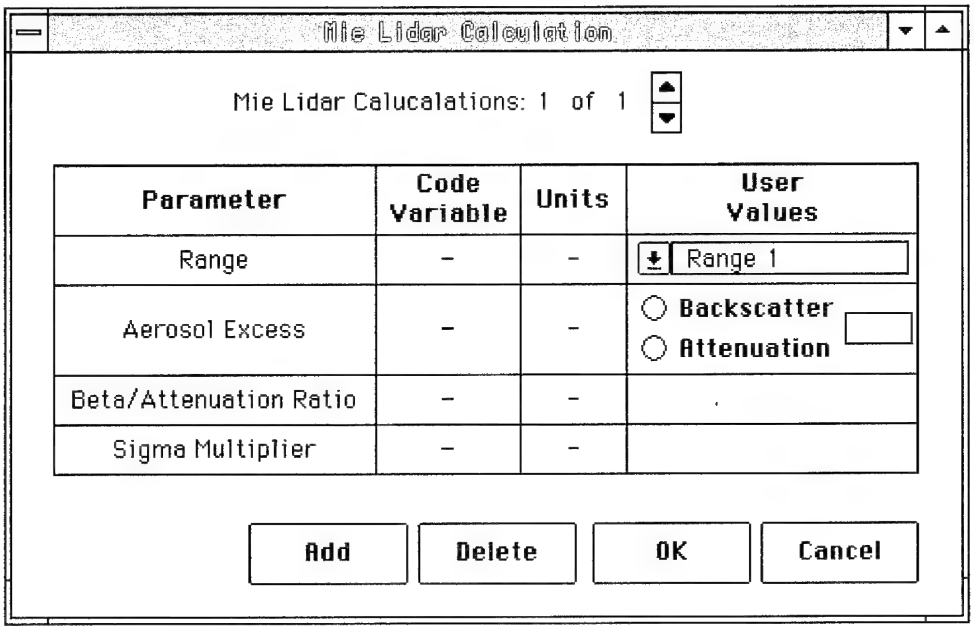


Figure A-172. UVTRAN Mie Lidar Calculation Screen

The Fluorescence Lidar Calculation screen, shown in Figure A-173, incorporates data from the FLID card. The first variable, Range, choices will be based on the values of the Lidar screen. Each range interval will be accessible through a dynamically created list.

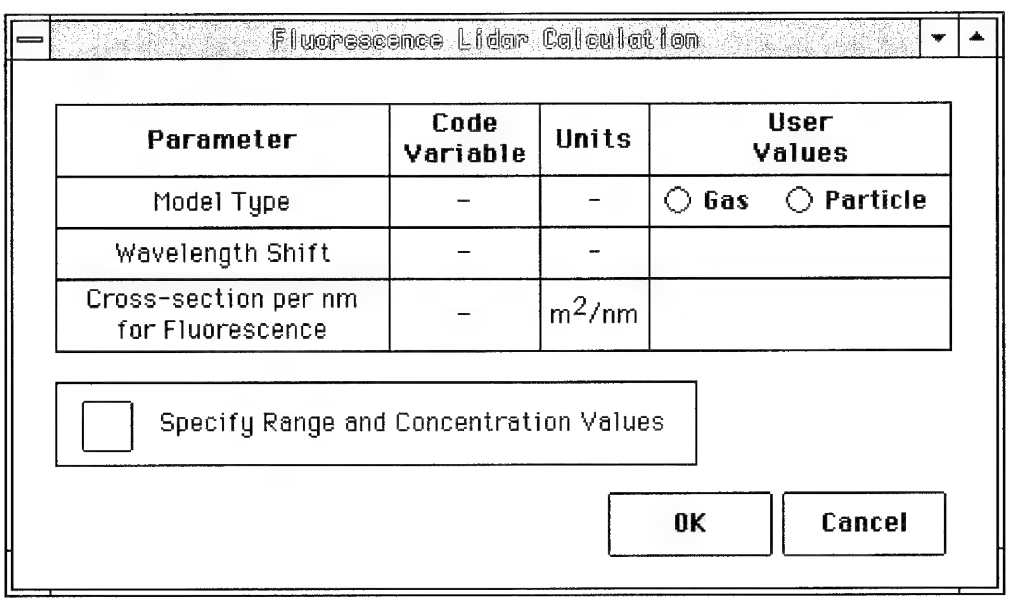


Figure A-173. UVTRAN Fluorescence Lidar Calculation Screen

The Fluorescence Range and Concentration screen, shown in Figure A-174, incorporates data from the MLID modification card. The first variable, Range, choices will be based on the values of the Lidar screen. Each range interval will be accessible through a dynamically created list.

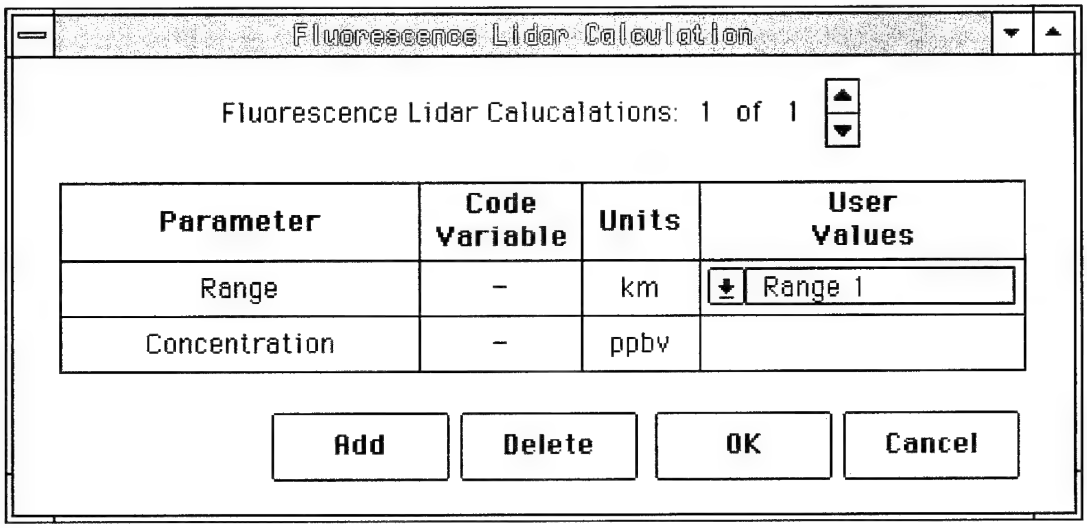


Figure A-174. UVTRAN Fluorescence Range and Concentration Screen

The Lidar System Modifications screen, shown in Figure A-175 incorporates data from the LSYS card. The default values are shown. The shading on the window will indicate whether the value is a default or user specified. The user can also get the default value from the content sensitive help.

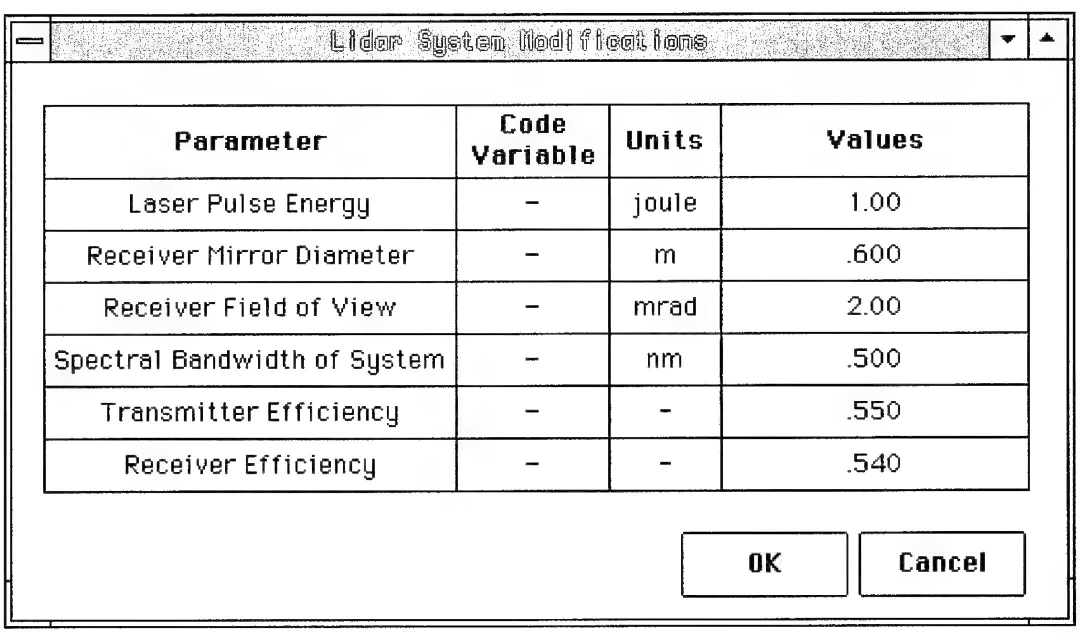


Figure A-175. UVTRAN Lidar System Modifications Screen

A.20 Natural Aerosol Extinction (XSCALE) Module

The Natural Aerosol Extinction (XSCALE) module calculates the transmittance through the naturally occurring aerosols haze, fog, rain, snow, and icefog. The user can specify data for multiple runs. CLIMAT can be called if that option is chosen. Card requirements were not given. Figure A-176 shows the Input Menu Choices. XSCALE input screens are Aerosol, Meteorological and Detector Data, Horizontal, Slant Path Predictions, Cloud Parameters, Icefog Aerosol Information, and Detector Response Function.

XSCALE

Input Menu
Aerosol, Meteorological and Detector Data
Horizontal
Slant Path Predictions
Cloud Parameters
Icefog Aerosol Information
Detector Response Function

Figure A-176. XSCALE Input Menu Choices

The Aerosol, Meteorological, and Detector screen, shown in Figure A-177, incorporates data from the AERO card. The Aerosol Index parameter determines the necessity of other parameters on this screen. These dependent parameters will become active or inactive based on the selection of the aerosol index. When the meteorological data are needed, the user can either specify the data or choose to use data from CLIMAT.

Parameter	Code Variable	Units	User Values
Aerosol Type	IAERO	-	Accept the algorithm defaults
Detector Radius	RD	cm	
Rain Rate	RNRT	mm/hr	

○ Use CLIMAT Data ○ Use User Specified Data

Parameter	Code Variable	Units	User Values
Relative Humidity	RH	percent	0
Temperature	TEMP	°C	0 100
Wind Speed	WNDVEL	m/sec	

OK Cancel

Figure A-177. XSCALE Aerosol, Meteorological and Detector Data

The Horizontal screen, shown in Figure A-178, incorporates data from the HORZ card.

Horizontal Path

Parameter	Code Variable	Units	User Values
Horizontal Distance	**HORDI**	km	
Altitude	**ALT**	km	

OK **Cancel**

Figure A-178. XSCALE Horizontal Screen

The Slant Path Predictions screen, shown in Figure A-179, incorporates data from the SLNH, SLNS and PLOT card.

Slant Path Preductions

Parameter	Code Variable	Units	User Values
Horizontal Distance	**HORDI**	km	
Slant Distance	**SLNDI**	km	
Elevation Angle	**ANG**	degrees	
Altitude	**ALT**	km	
Saving Profile Option	**NPLT**	-	○ **Do Not Save** ○ **Save**
Slant File Name	-	-	PROFIL

OK **Cancel**

Figure A-179. XSCALE Slant Path Predictions Screen

The Cloud Parameters screen, shown in Figure A-180, incorporates data from the CLD card.

Cloud Parameters

○ Include Effect of Cloud ○ Do Not Include Effect of Cloud

Parameter	Code Variable	Units	User Values
Cloud Ceiling Height	CEILHT	km	
Cloud Thickness	THICK	km	

○ Model Inversion Layer ○ Do Not Model Inversion Layer

Parameter	Code Variable	Units	User Values
Inversion Layer Thickness	AINVHT	km	

OK Cancel

Figure A-180. XSCALE Cloud Parameters Screen

The Icefog Aerosol Information screen, shown in Figure A-181, incorporates data from the ICEF card. Water vapor source parameter determines whether the other parameters need to be specified. Dependent parameters will become active or inactive based on the selection of the water vapor source parameter.

Icefog Aerosol Information

Parameter	Code Variable	Units	User Values
Water Vapor Source	ISOURC	-	Accept the algorighm defaults
Fraction of Particles	DECPER	-	
Mean Diameter of Source Particles	XMEAN	m	
Mode Diameter of Source Particles	XMODE	m	
Nearness of Open Water	IWATER	-	○ Water Not Nearby ○ Water Nearby

OK Cancel

Figure A-181. XSCALE Icefog Aerosol Information Screen

The Detector Response Function screen, shown in Figure A-182, incorporates data from the RESF card. The user can specify up to 20 wavelength and response value pairs. The user can specify the number of pairs before entering them or enter the pairs of numbers and the sum will be calculated for the user.

Parameter	Code Variable	Units	User Values
Number of Wavelength Dependent Sensor Response Function Values Specified	NBR	-	

Wavelength	Response Value	Wavelength	Response Value

OK Cancel

Figure 182. XSCALE Detector Response Function Screen

APPENDIX B

COMBIC Interface Windows

Appendix B
List of Figures

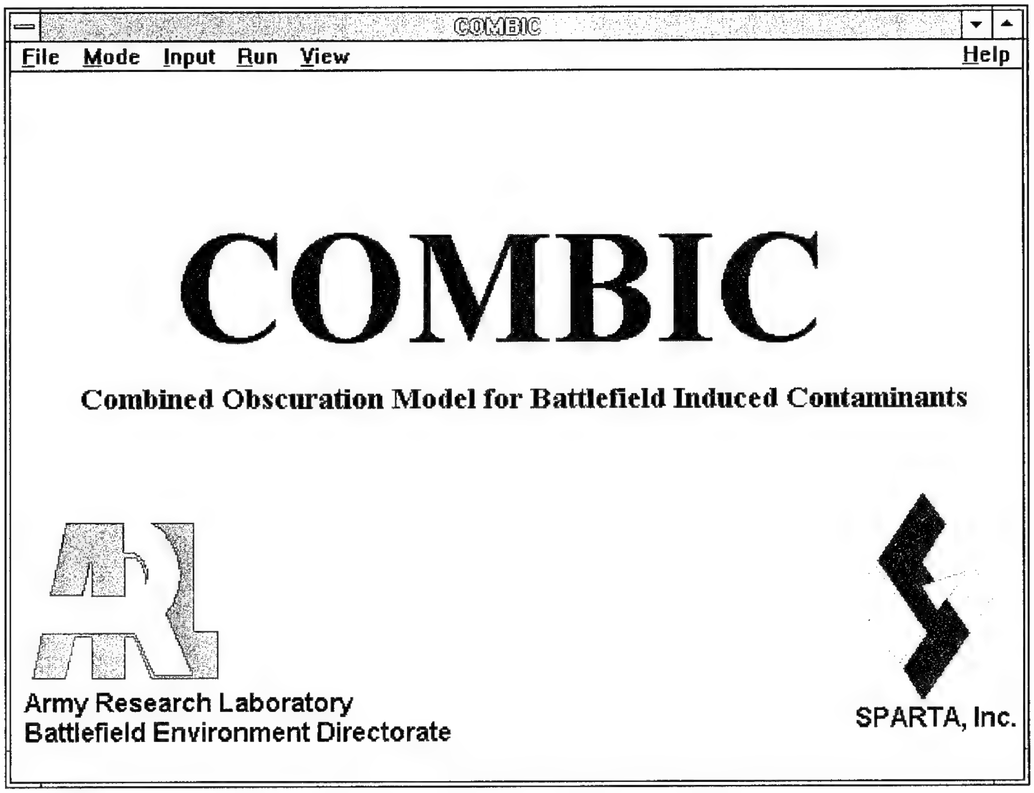


Figure B-1. COMBIC Main Window

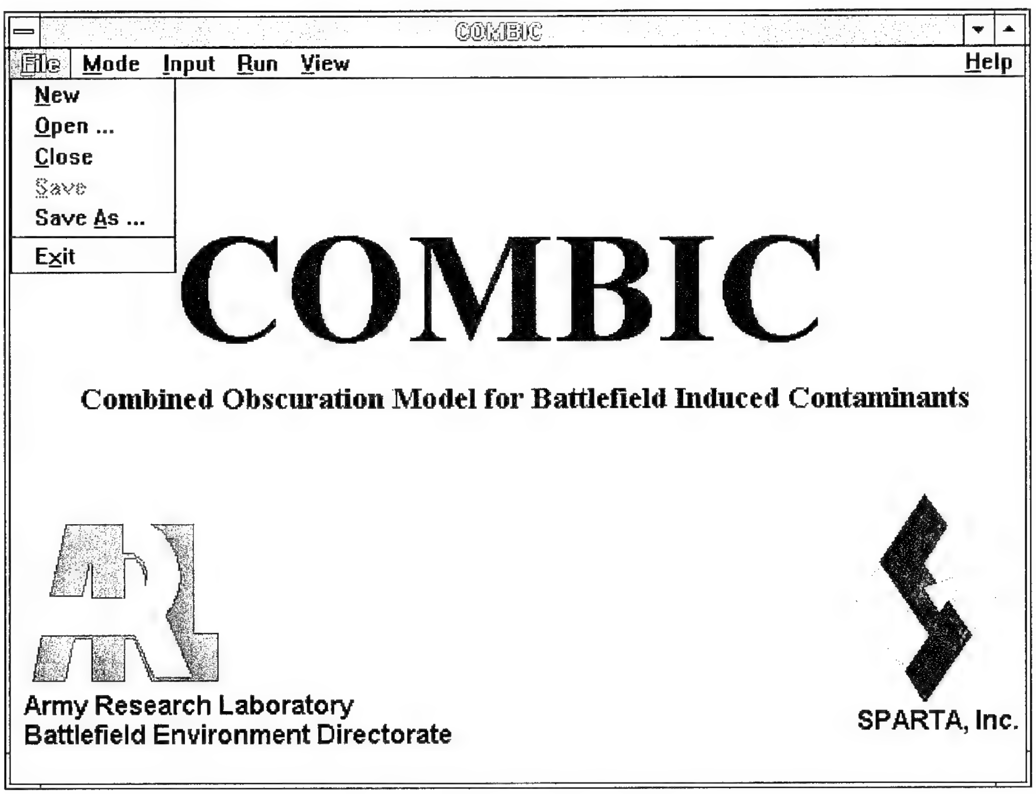


Figure B-2. File Menu

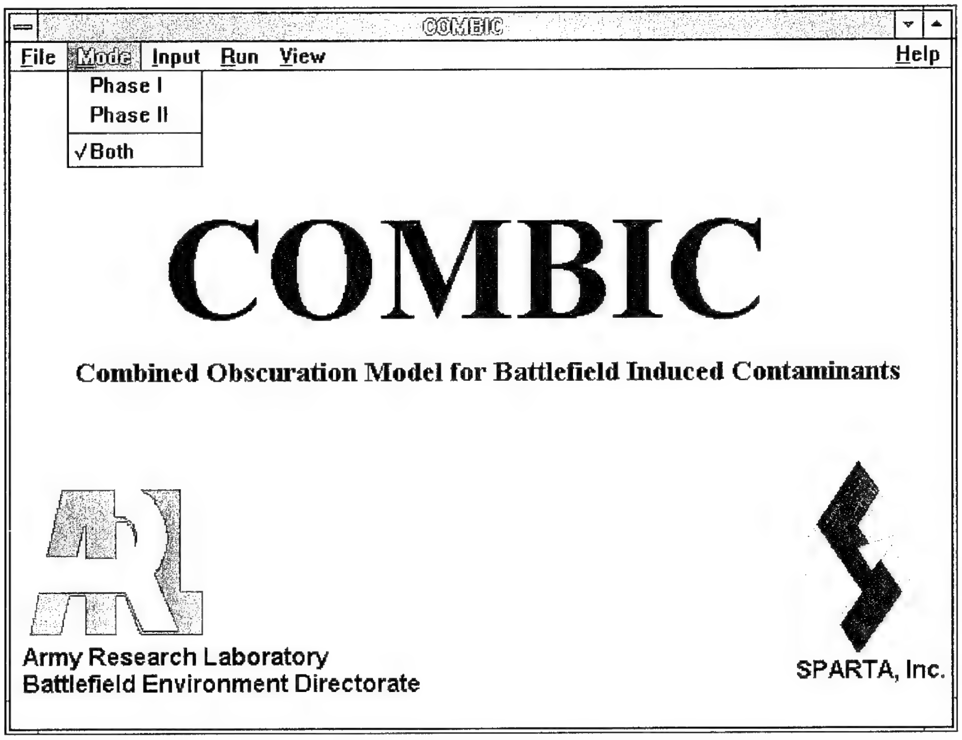


Figure B-3. Mode Menu

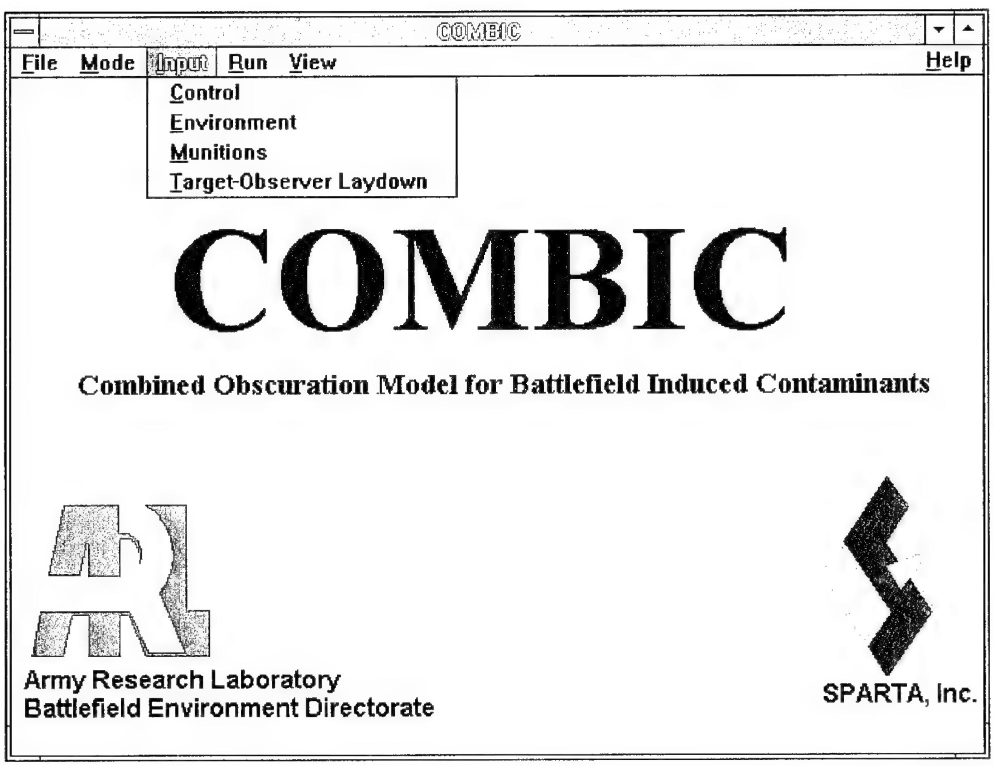


Figure B-4. Input Menu

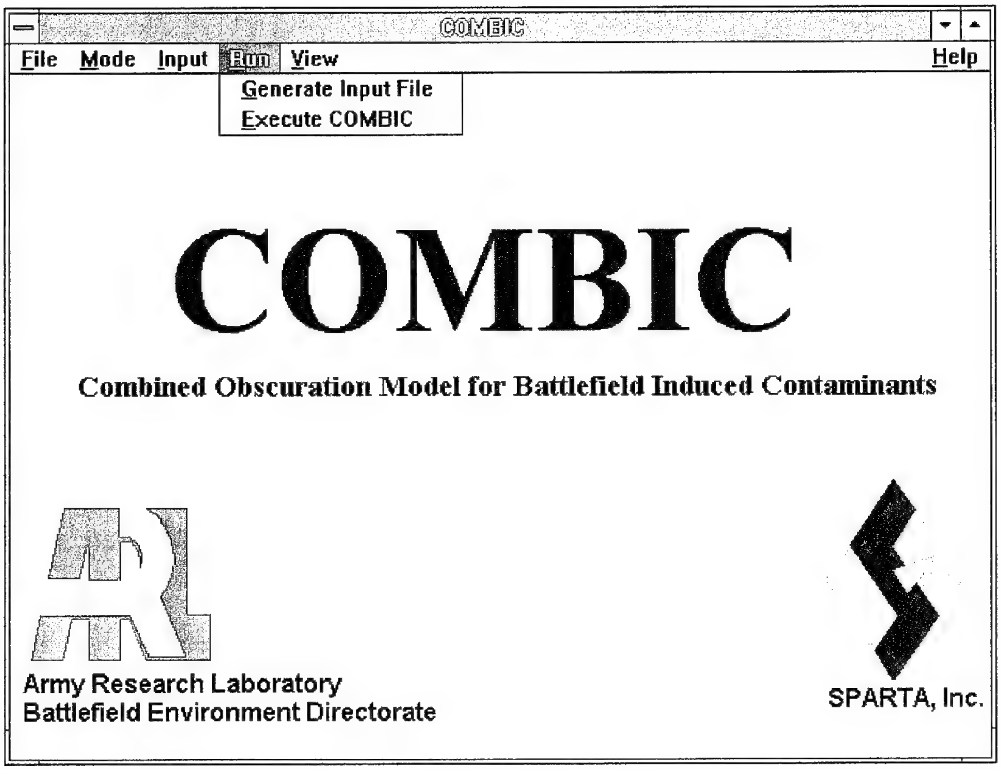


Figure B-5. Run Menu

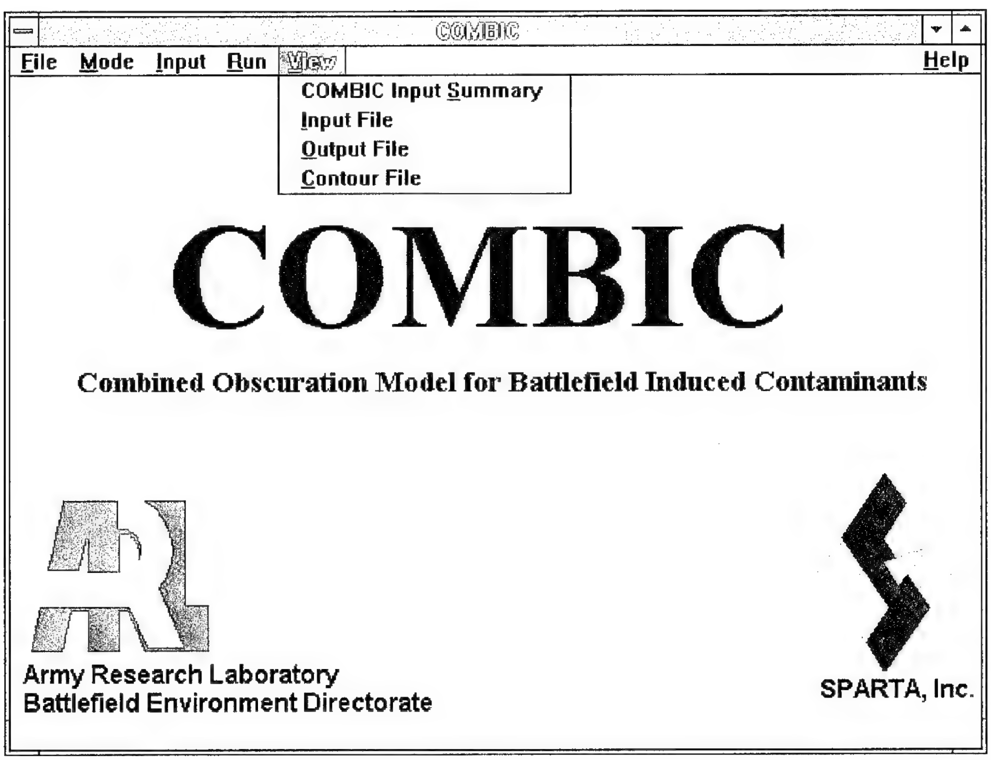


Figure B-6. View Menu

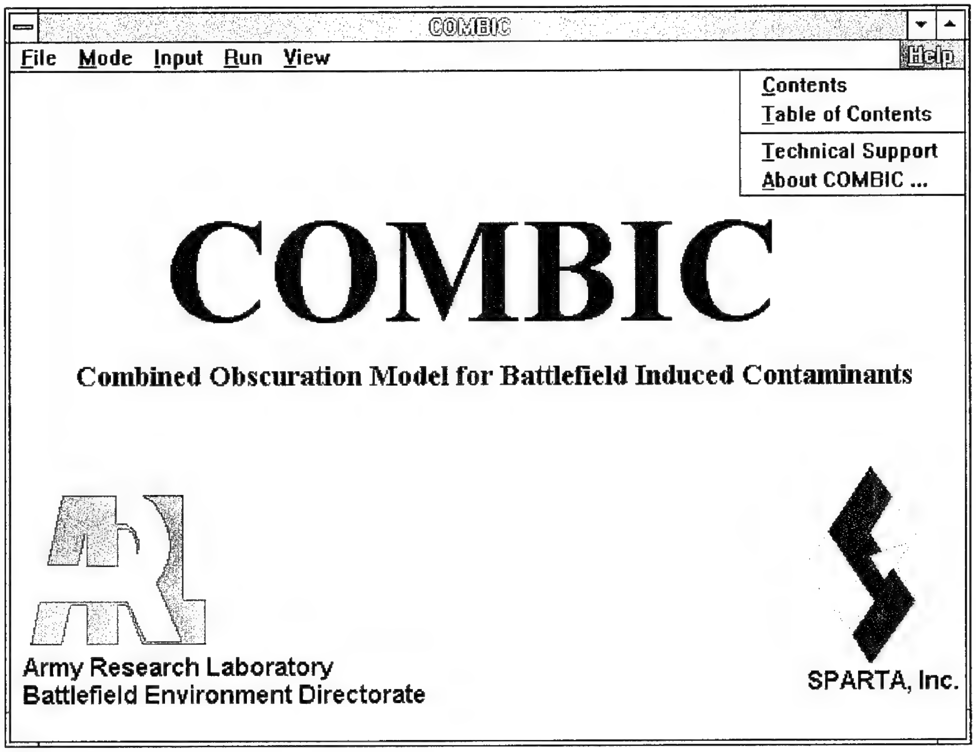


Figure B-7. Help Menu

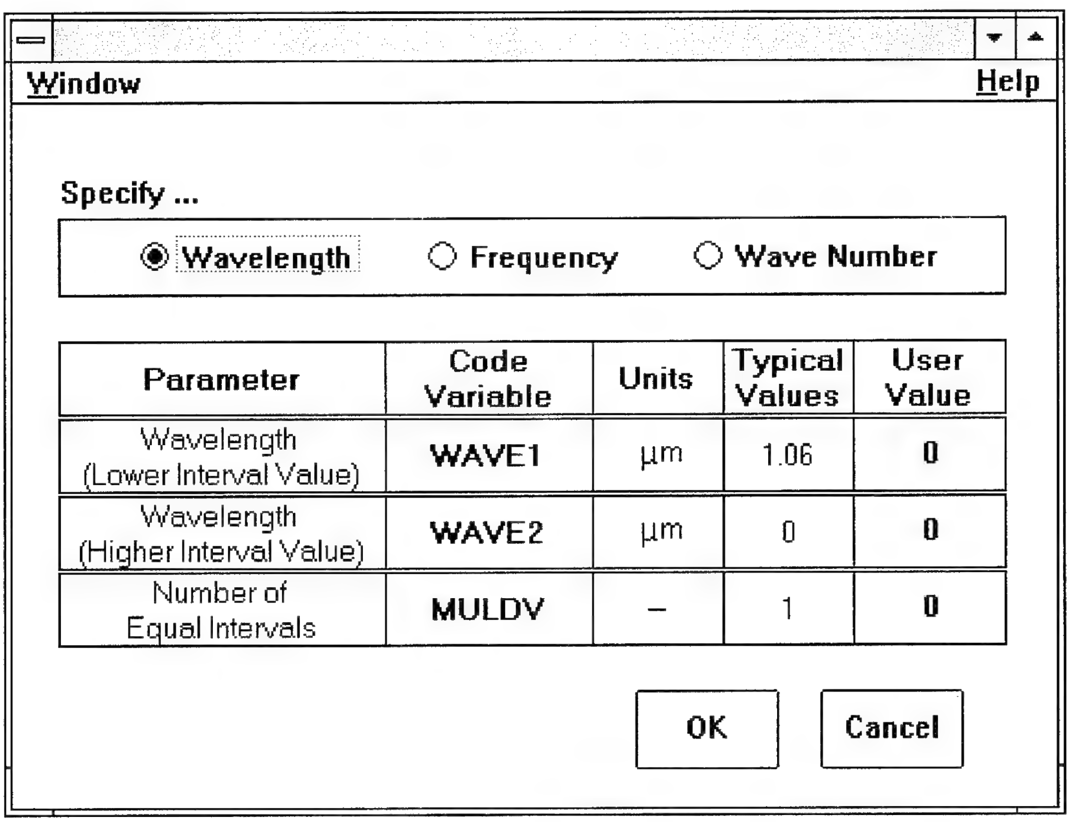


Figure B-8. Control Parameters Window - WAVL, FREQ, WVNUM

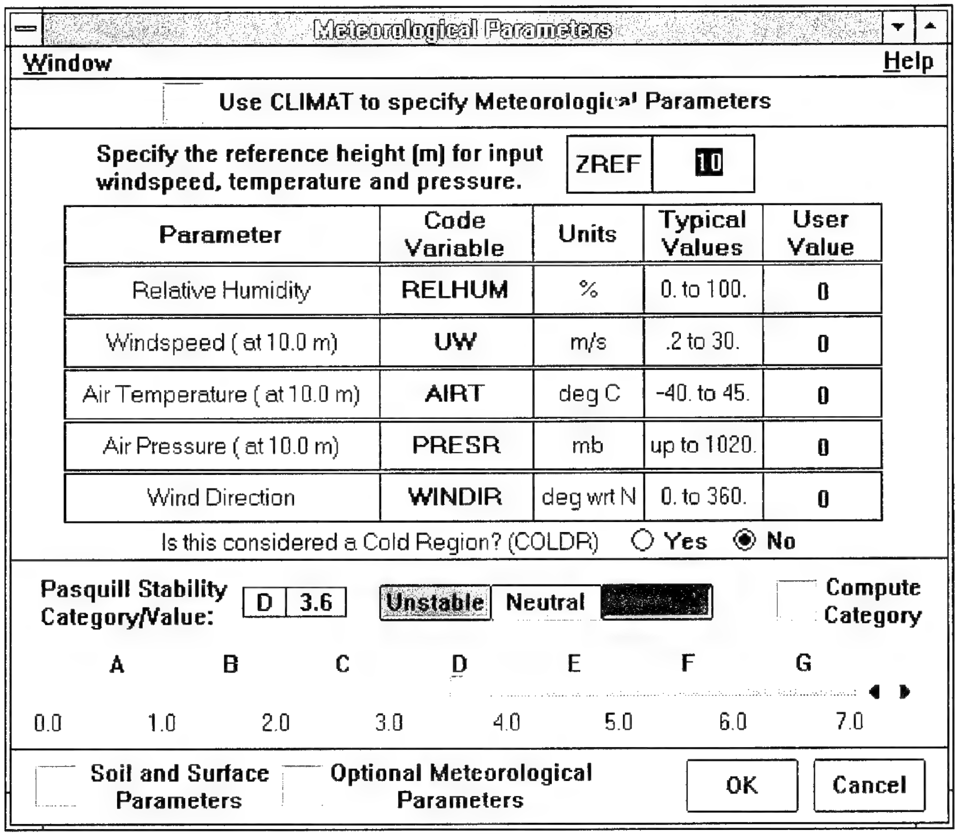


Figure B-9. Input Environment Window - MET1

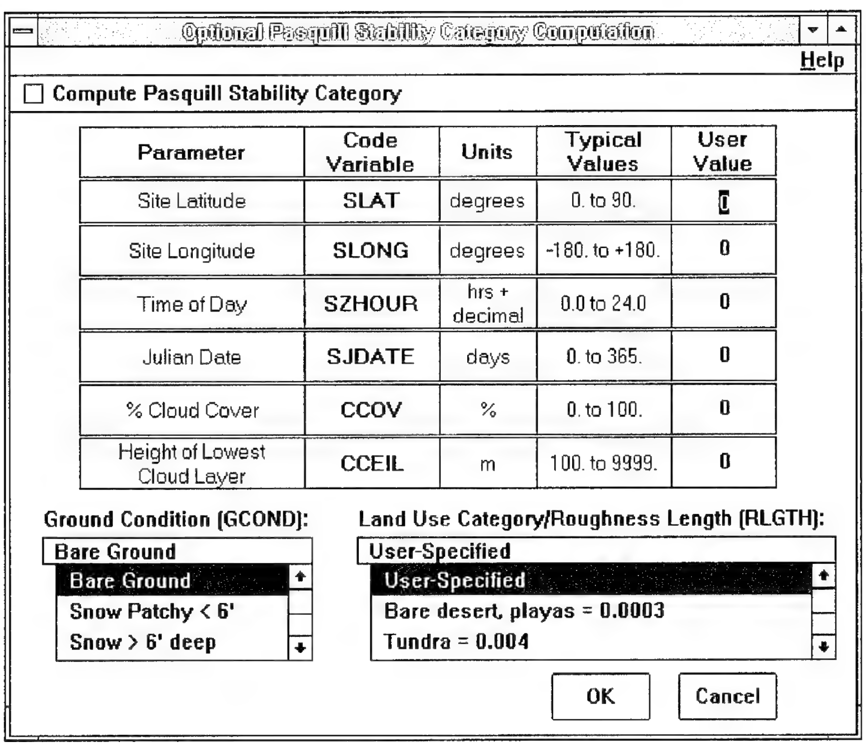


Figure B-10. Compute Pasquill Stability Window - PSQ1, PSQ2

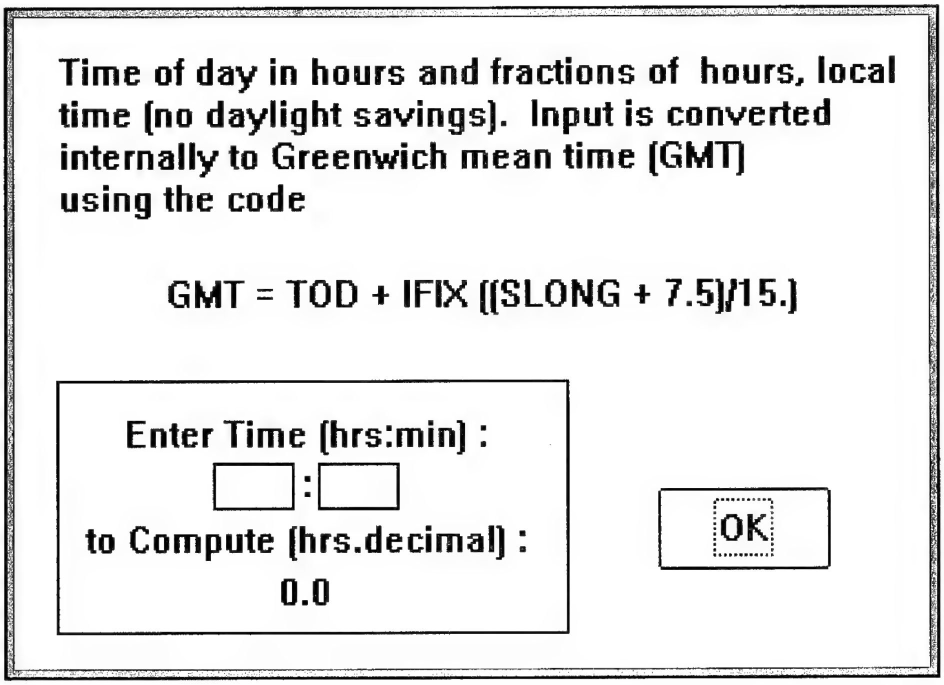


Figure B-11. Context Sensitive Help - Compute SZHOUR

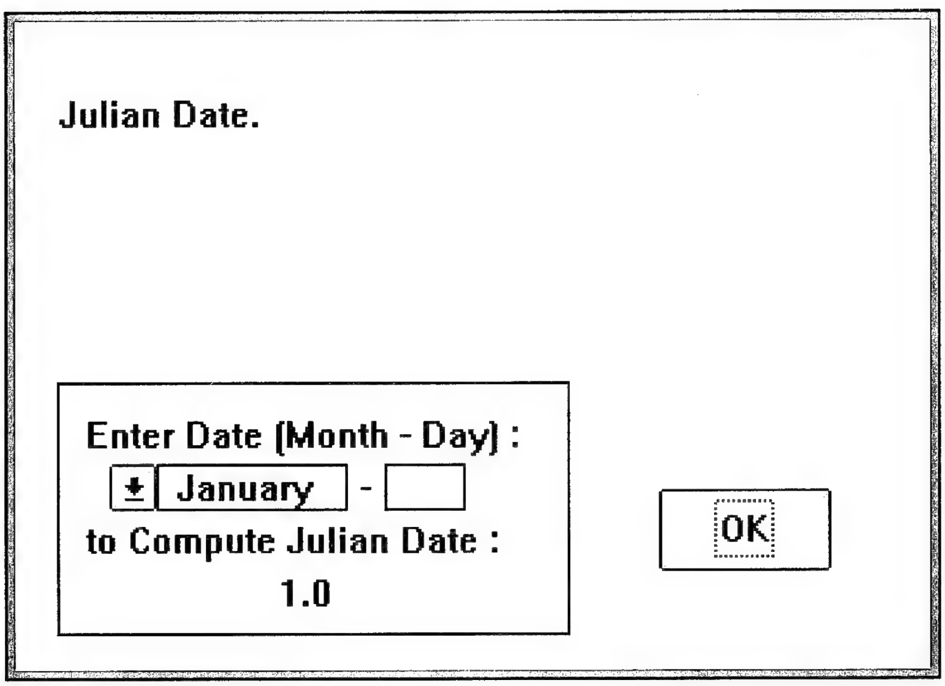


Figure B-12. Context Sensitive Help - Compute SJDATE

Soil and Surface Parameters

Help

☐ **Specify Soil and Surface Parameters**

These parameters allow the user to modify the environment parameters that affect cloud diffusion (ZNOT) or obscurant production.

Parameter	Code Variable	Units	Typical Values	User Value
Surface Roughness	**ZNOT**	m	.001 to 5.	0
Surface Soil Silt Content	**SILT**	%	0. to 100.	0
Depth of Sod Cover	**SOD**	m	0. to 2.	0
Snow Cover	**SNOW**	-	Yes or No	○ Yes ◉ No

OK Cancel

Figure B13. Soil and Surface Parameters Window - TERA

Optional Meteorological Parameters

Help

☐ **Specify Optional Meteorological Parameters**

Parameter	Code Variable	Units	Typical Values	User Value
Inversion Height	**ZINV**	m	30. to 1000.	0

The following parameters are used only in sensitivity studies or boundary layer model effects.

Parameter	Code Variable	Units	Typical Values	User Value
Average Static Stability FLAG	**SBARM**	-	Yes or No	○ Yes ◉ No
Average Static Stability Parameter	SBAR	s^{-2}	varies	0
Surface Friction Velocity	**USTAR**	m/s	.001 to 2.	☒ Internal Model
Sensible Heat Flux	**SHFLX**	watt/m^2	varies	☒ Internal Model

OK Cancel

Figure B-14. Optional Meteorological Parameters Window - MET2

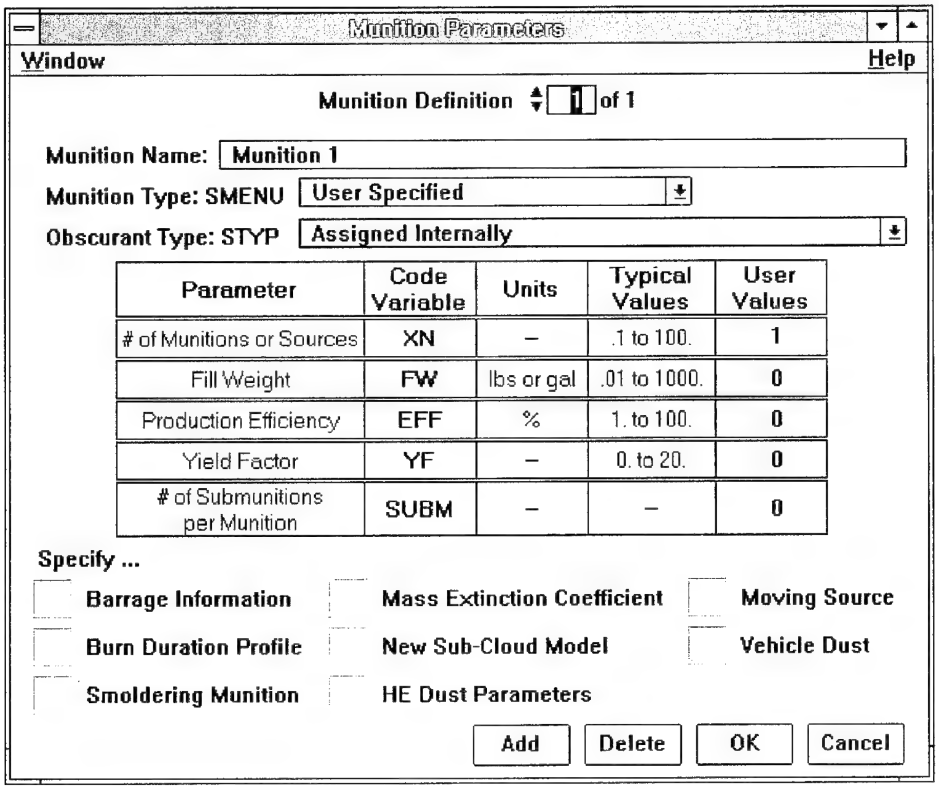


Figure B-15. Munition Definition Window - MUNT

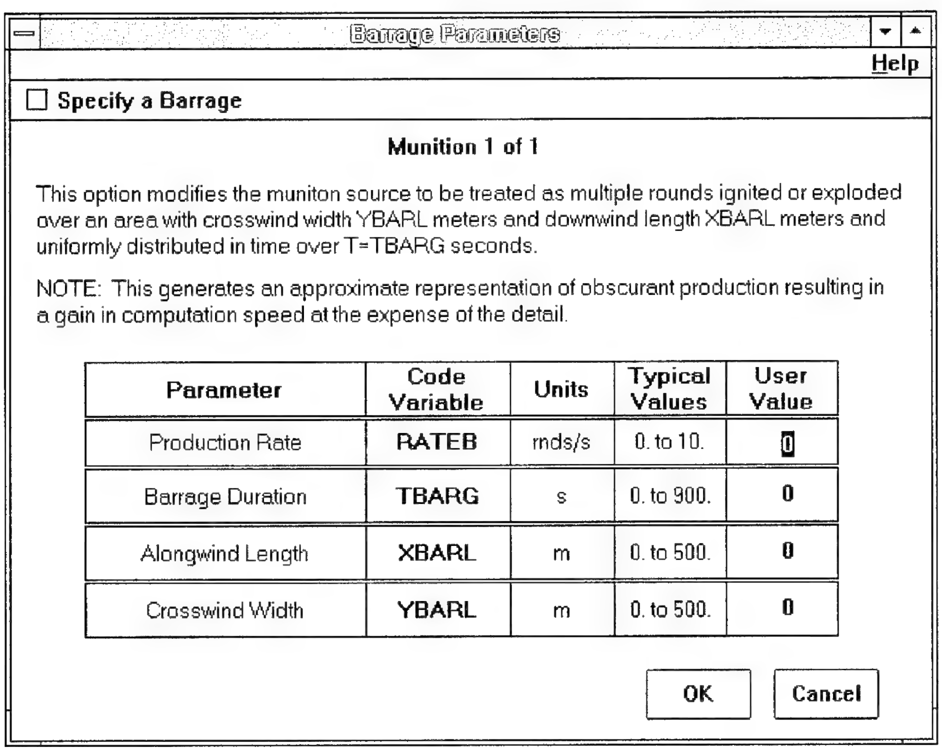
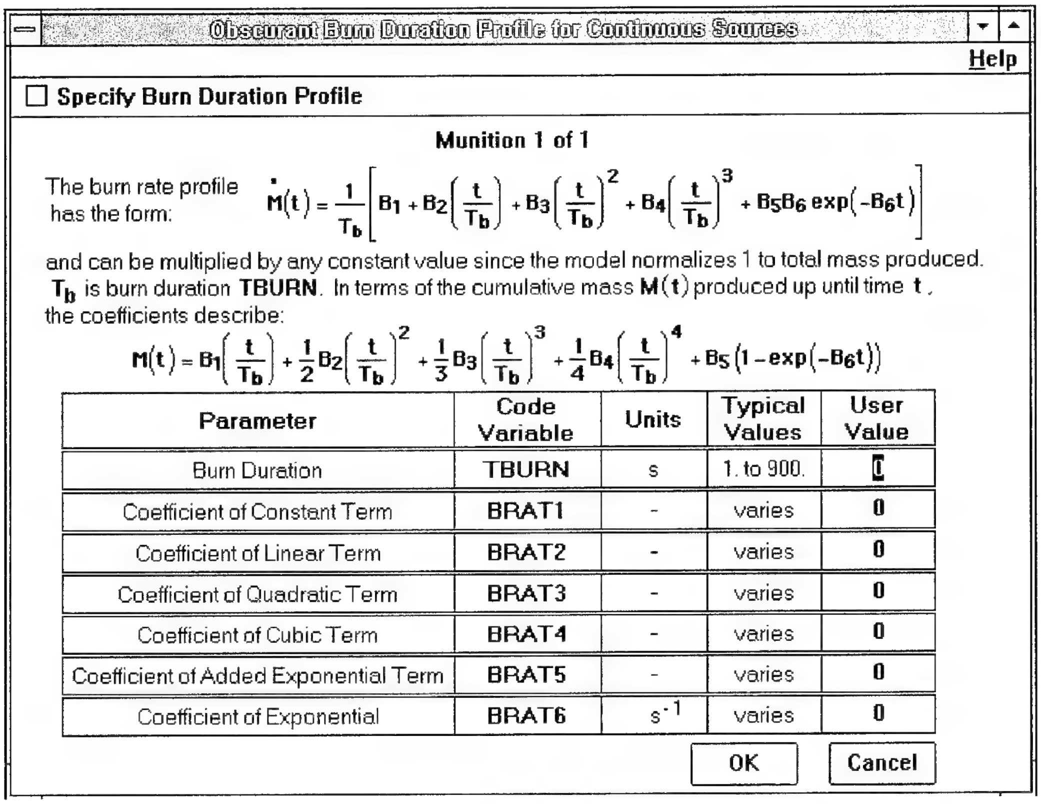


Figure B-16. Barrage Parameters Window - BARG



Obscurant Burn Duration Profile for Continuous Sources

Help

☐ **Specify Burn Duration Profile**

Munition 1 of 1

The burn rate profile has the form:

$$\dot{M}(t) = \frac{1}{T_b}\left[B_1 + B_2\left(\frac{t}{T_b}\right) + B_3\left(\frac{t}{T_b}\right)^2 + B_4\left(\frac{t}{T_b}\right)^3 + B_5B_6\exp(-B_6t)\right]$$

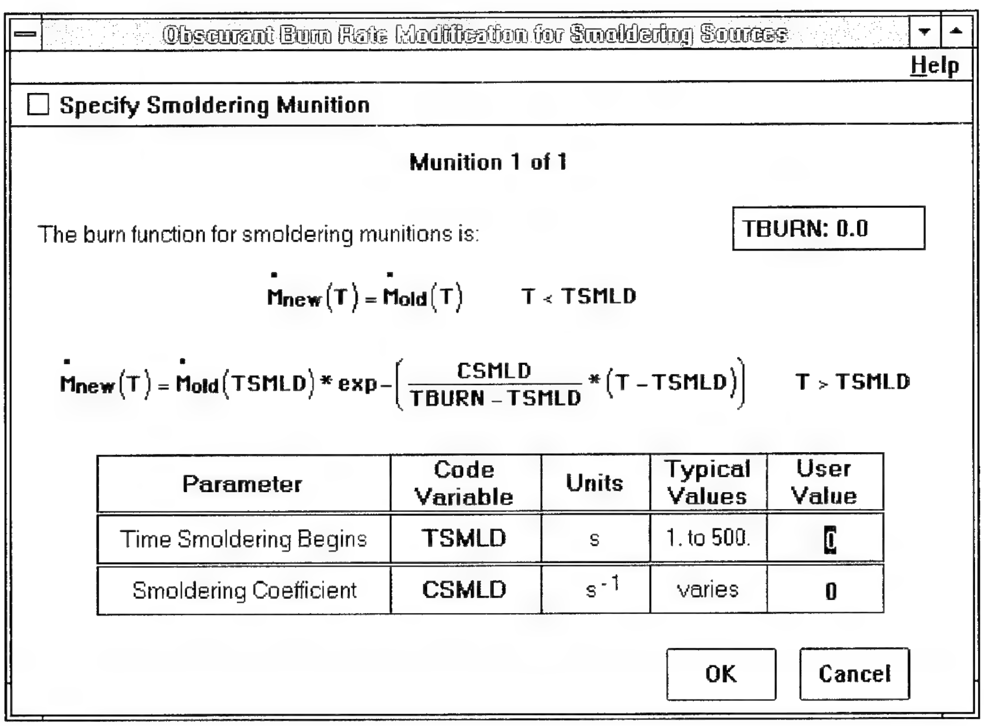
and can be multiplied by any constant value since the model normalizes 1 to total mass produced. T_b is burn duration **TBURN**. In terms of the cumulative mass $M(t)$ produced up until time t, the coefficients describe:

$$M(t) = B_1\left(\frac{t}{T_b}\right) + \frac{1}{2}B_2\left(\frac{t}{T_b}\right)^2 + \frac{1}{3}B_3\left(\frac{t}{T_b}\right)^3 + \frac{1}{4}B_4\left(\frac{t}{T_b}\right)^4 + B_5\left(1-\exp(-B_6t)\right)$$

Parameter	Code Variable	Units	Typical Values	User Value
Burn Duration	TBURN	s	1. to 900.	0
Coefficient of Constant Term	BRAT1	-	varies	0
Coefficient of Linear Term	BRAT2	-	varies	0
Coefficient of Quadratic Term	BRAT3	-	varies	0
Coefficient of Cubic Term	BRAT4	-	varies	0
Coefficient of Added Exponential Term	BRAT5	-	varies	0
Coefficient of Exponential	BRAT6	s^{-1}	varies	0

OK Cancel

Figure B-17. Burn Duration Profile Window - BURN



Obscurant Burn Rate Modification for Smoldering Sources

Help

☐ **Specify Smoldering Munition**

Munition 1 of 1

The burn function for smoldering munitions is: **TBURN: 0.0**

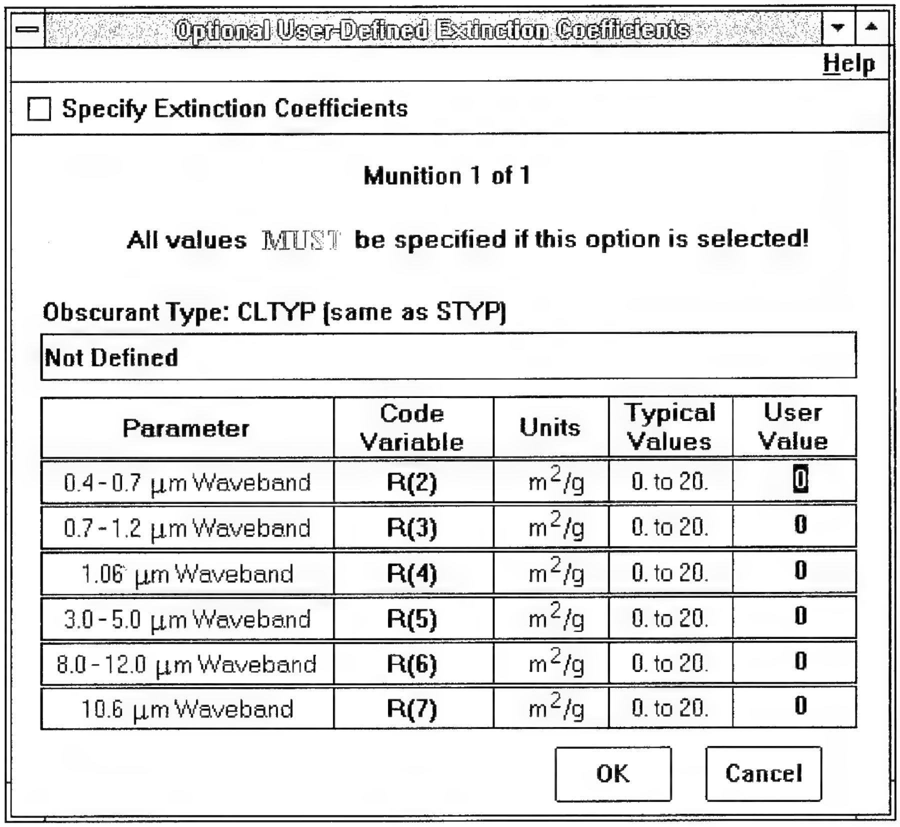
$$\dot{M}_{new}(T) = \dot{M}_{old}(T) \qquad T < TSMLD$$

$$\dot{M}_{new}(T) = \dot{M}_{old}(TSMLD) * \exp-\left(\frac{CSMLD}{TBURN - TSMLD} * (T - TSMLD)\right) \qquad T > TSMLD$$

Parameter	Code Variable	Units	Typical Values	User Value
Time Smoldering Begins	TSMLD	s	1. to 500.	0
Smoldering Coefficient	CSMLD	s^{-1}	varies	0

OK Cancel

Figure B-18. Smoldering Source Parameters Window - SMLD



Optional User-Defined Extinction Coefficients

Help

☐ Specify Extinction Coefficients

Munition 1 of 1

All values MUST be specified if this option is selected!

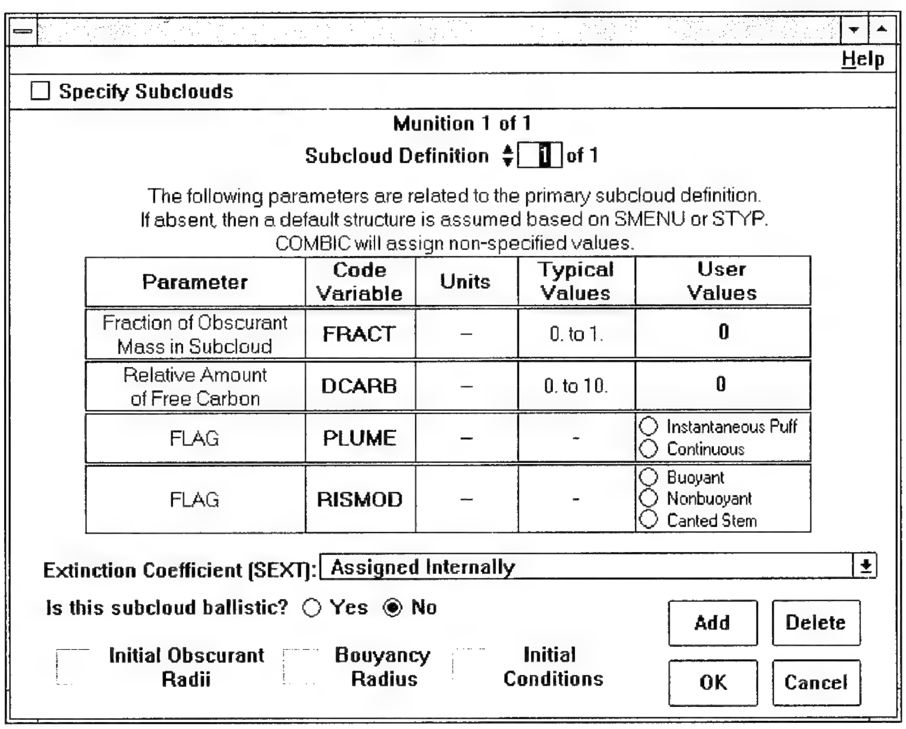
Obscurant Type: CLTYP (same as STYP)

Not Defined

Parameter	Code Variable	Units	Typical Values	User Value
0.4 - 0.7 μm Waveband	R(2)	m^2/g	0. to 20.	0
0.7 - 1.2 μm Waveband	R(3)	m^2/g	0. to 20.	0
1.06 μm Waveband	R(4)	m^2/g	0. to 20.	0
3.0 - 5.0 μm Waveband	R(5)	m^2/g	0. to 20.	0
8.0 - 12.0 μm Waveband	R(6)	m^2/g	0. to 20.	0
10.6 μm Waveband	R(7)	m^2/g	0. to 20.	0

OK Cancel

Figure B-19. Extintion Coefficients Window - EXTC



Help

☐ Specify Subclouds

Munition 1 of 1

Subcloud Definition 1 of 1

The following parameters are related to the primary subcloud definition.
If absent, then a default structure is assumed based on SMENU or STYP.
COMBIC will assign non-specified values.

Parameter	Code Variable	Units	Typical Values	User Values
Fraction of Obscurant Mass in Subcloud	FRACT	–	0. to 1.	0
Relative Amount of Free Carbon	DCARB	–	0. to 10.	0
FLAG	PLUME	–	-	○ Instantaneous Puff ○ Continuous
FLAG	RISMOD	–	-	○ Buoyant ○ Nonbuoyant ○ Canted Stem

Extinction Coefficient (SEXT): Assigned Internally

Is this subcloud ballistic? ○ Yes ◉ No

Initial Obscurant Radii   Bouyancy Radius   Initial Conditions

Add Delete OK Cancel

Figure B-20. Subcloud Definition Window - SUBA

Help

☐ **Specify Initial Obscurant Radii**

Subcloud 1 of 1

All parameters default to model or menu values if input as 0. or not supplied.

Parameter	Code Variable	Units	Typical Values	User Values
Initial Cloud Radius Downwind	ROBSX	m	1. to 50.	0
Initial Cloud Radius Crosswind	ROBSY	m	1. to 50.	0
Initial Cloud Radius Vertical	ROBSZ	m	1. to 50.	0

OK Cancel

Figure B-21. Subcloud Initial Obscurant Radii Window - SUBB

Help

☐ **Specify Bouyancy Characteristics**

Subcloud 1 of 1

With the exception of WUP, all parameters default to model or menu values if input as 0. or not supplied.

Parameter	Code Variable	Units	Typical Values	User Values
Bouyancy Radius	RBUO	m	.01 to 10.	0
Mean Cloud Temperature	TCLOUD	^{o}K	270. to 9999.	0
Thermal Production Coefficient	QOBS	cal/g obsc	0. to 2000.	0
Initial Upward Velocity	WUP	m/s	0. to 100.	0

OK Cancel

Figure B-22. Subcloud Bouyancy Characteristics Window - SUBB

Help

☐ **Specify Initial Conditions**

Subcloud 1 of 1

Only EVAPF defaults to internal stored or modeled values if input as 0.

Parameter	Code Variable	Units	Typical Values	User Values
Initial Height	ZBURST	m	0. to 50.	0
Fall Velocity	VFALL	m/s	0. to 10.	0
Limiting Fraction	EVAPF	-	0. to 1.	0
Evaporation Parameter	EVAPD	s^{-1}	0. to 10.	0
Reflection Coefficient	REFCO	-	0. to 1.	0
Momentum Radius	RMOM	m	0. to 10.	0
Horizontal Velocity	VHOR	m/s	0. to 100.	0

OK Cancel

Figure B-23. Subcloud Initial Conditions Window - SUBC

HE Dust Parameters

Help

☐ **Specify HE Dust Parameters**

Munition 1 of 1

DOB, DELIV, CASEL, CASED, and CYDEG are ignored if YF is nonzero. YF: 0.0

Parameter	Code Variable	Units	Typical Values	User Value
Depth of Burst	DOB	m	-5. to 5.	0
Length of Casing	CASEL	m	.1 to 2.	0
Diameter of Casing	CASED	m	.01 to 1.	0
Dip Angle	CYDEG	deg	0. to 90.	0
Delivery Type	DELIV	-	-	○ Uncased Static ○ Cased Static ○ Cased Live Fire

- Wet Cohesive Soil
- Wet Sand, Moist Cohesive Soils
- Dry-to-Moist Sand
- Dry Sandy
- Dry Cohesive Soil
- Rock

Soil Type (SOIL): 0

OK Cancel

Figure B-24. HE Dust Parameters Window - DUST

Moving Source Parameters

Help

☐ **Specify a Moving Source**

Munition 1 of 1

Any obscurant can be specified as a moving source. This passes speed and direction to Phase II. It is more common, however, to use Phase II inputs to specify sources as moving.

Parameter	Code Variable	Units	Typical Values	User Values
Moving Source Speed	VSPEED	m/s	0. to 35.	0
Moving Source Direction	VEHDIR	deg	0. to 360.	0

OK   Cancel

Figure B-25. Moving Sources Window - VEHC

Vehicular Dust Parameters

Help

☐ **Specify Vehicular Dust**

Munition 1 of 1

If the total dust is input as a fill weight (FW) on the previous window, the internal vehicular dust model will not be used. The dust production rate is then determined from TBURN specified with the Burn Duration Profile.

Parameter	Code Variable	Units	Typical Values	User Values
Moving Source Speed	VSPEED	m/s	0. to 35.	0
Vehicle Width	VWIDTH	m	0. to 4.	0
Vehicle Weight	VWEIGH	tons	0. to 70.	0
Vehicle Type	VEHTYP	–	-	◉ Wheeled ○ Tracked
Moving Source Direction	VEHDIR	deg	0. to 360.	0

OK   Cancel

Figure B-26. Vehicular Dust Parameters Window - VEHC

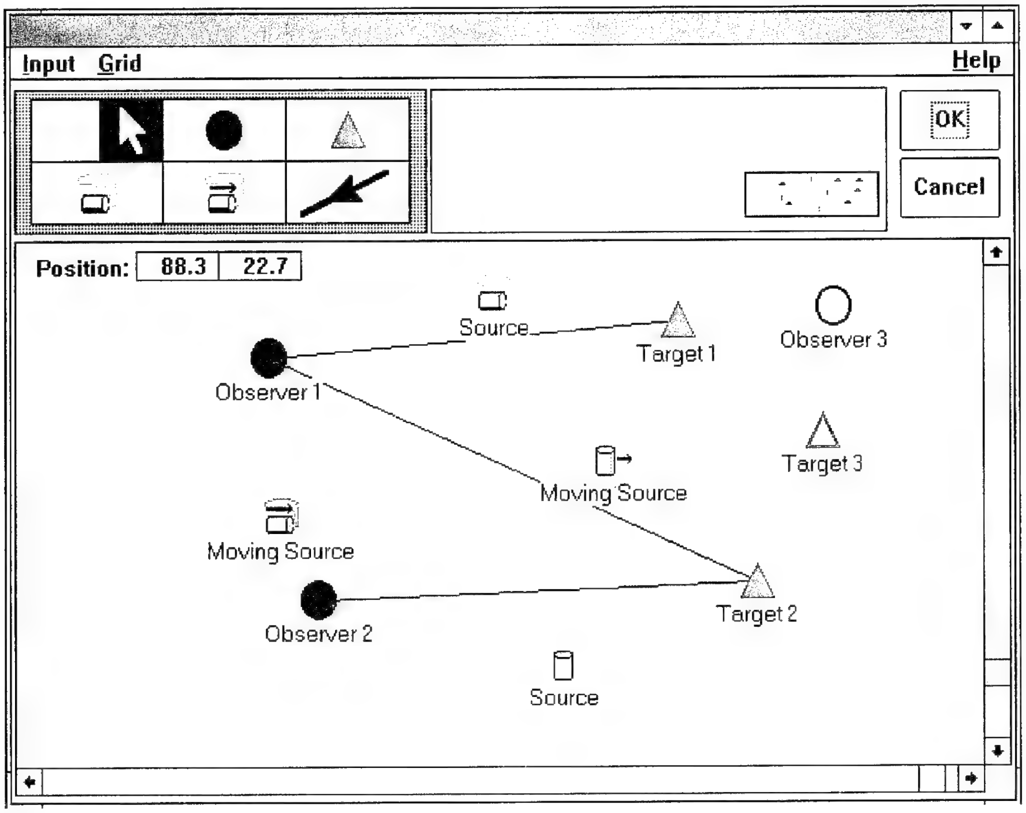


Figure B-27. Target-Observer Laydown Window

Origin

Help

Parameter	Code Variable	Units	Typical Values	User Values
Arbitrary X-Origin	**XORG**	m	0.	**0.0**
Arbitrary Y-Origin	**YORG**	m	0.	**0.0**
Arbitrary Z-Origin	**ZORG**	m	0.	**0.0**
Compass Heading	**XORDIR**	deg wrt N	0. to 360.	**0.0**
Wind Direction	**WNDIR**	deg wrt N	0. to 360.	**0.0**
Arbitrary Time Origin	**WNDIR**	s	0.	**0.0**

OK Cancel

Figure B-28. Origins Window - ORIG

Print Parameters

Help

Print Flag (PRNT):

- (selected) Suppress all output except ECHO, errors and VIEW/GREY pictures, if any.
- Print transmittance for all LOS that intersect at least one cloud.
- Also print pathlength and contributing histories for each contributing subcloud.
- Add a second output file (UNITC) to dump cloud positions and sizes with time.

Parameter	Code Variable	Units	Typical Values	User Value
Time to Begin Printout	**TBEGIN**	s	0. to 7200.	0
Time to End Printout	**TEND**	s	0. to 7200.	0
Time Increment for Printout	**TDEL**	s	0.1 to 10.	0

OK Cancel

Figure B-29. Print Parameters Window - LIST

Cloud Updates

Help

Parameter	Code Variable	Units	Typical Values	User Values
Time Updates Begin	**BEGIN**	s	0.	0
Time Updates End	**ENDT**	s	1. to 7200.	0
Time Increment for Cloud Updates	**DELT**	s	.1 to 10.	0
Minimum CL	**CLIM**	g/m^2	1. to 1000.	0
Cloud Removal Limit	**CLEND**	g/m^2	.001 to .1	0
Tolerance Level Romberg Integration	**CLACC**	%	0. to 100.	0

OK Cancel

Figure B-30. Cloud Updates Window - TIME

Observer Position and Viewing Times

Help

Observer Number (OBSN): 1

Name: Observer 1

Parameter	Code Variable	Units	Typical Values	User Values
Observer Position				
X Coordinate	XOBS	m	varies	-82.8
YCoordinate	YOBS	m	varies	-36.2
Z Coordinate	ZOBS	m	varies	0.0
Observer Active Viewing Time				
Start	STIMO	s	0. to 7200.	0.0
End	ETIMO	s	0. to 7200.	0.0

OK Cancel

Figure B-31. Observer Parameters Window - OLOC

Target Position

Help

Target Number (TARN): 1

Target Name: Target 1

Parameter	Code Variable	Units	Typical Values	User Values
Target Position				
X Coordinate	XTAR	m	varies	-65.8
YCoordinate	YTAR	m	varies	-40.1
Z Coordinate	ZTAR	m	varies	0.0

OK Cancel

Figure B-32. Target Parameters Window - TLOC

Scenario Source Specification

Help

Source Name: Source

Phase I Name: Load Phase I Munitions First !

Parameter	Code Variable	Units	Typical Values	User Values
# of Munition or Sources	XN	-	varies	1
Source Position				
X Coordinate	XM	m	varies	-71.2
YCoordinate	YM	m	varies	-29.6
Z Coordinate	ZM	m	varies	0.0
Source Active Time				
Start	STIM	s	0. to 7200.	0.0
End	ETIM	s	0. to 7200.	0.0

OK Cancel

Figure B-33. Source Parameters Window - SLOC

Scenario Moving Source Specification

Help

Moving Source Name: Moving Source

Phase I Name: Load Phase I Munitions First !

Parameter	Code Variable	Units	Typical Values	User Values
# of Munition or Sources	XNV	-	varies	1.0
Source Starting Position, Direction and Speed				
Starting X Coordinate	XSTAR	m	varies	-54.1
Starting Y Coordinate	YSTAR	m	varies	-30.6
Starting Z Coordinate	ZSTAR	m	varies	0.0
Direction	VDIR	deg wrt N	0. to 360.	0.0
Speed	VSPEED	m/s	0. to 35.	0.0
Source Active Time				
Start	STIMV	s	0. to 7200.	0.0
End	ETIMV	s	0. to 7200.	0.0
Remove	ETIMC	s	0. to 7200.	0.0

OK Cancel

Figure B-34. Moving Source Parameters Window - VEH1, VEH2

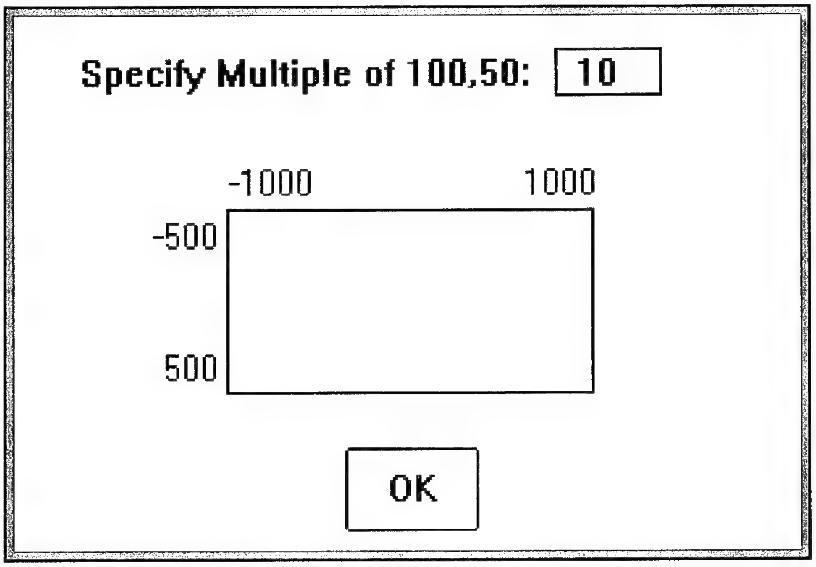


Figure B-35. Grid Size Specification Window

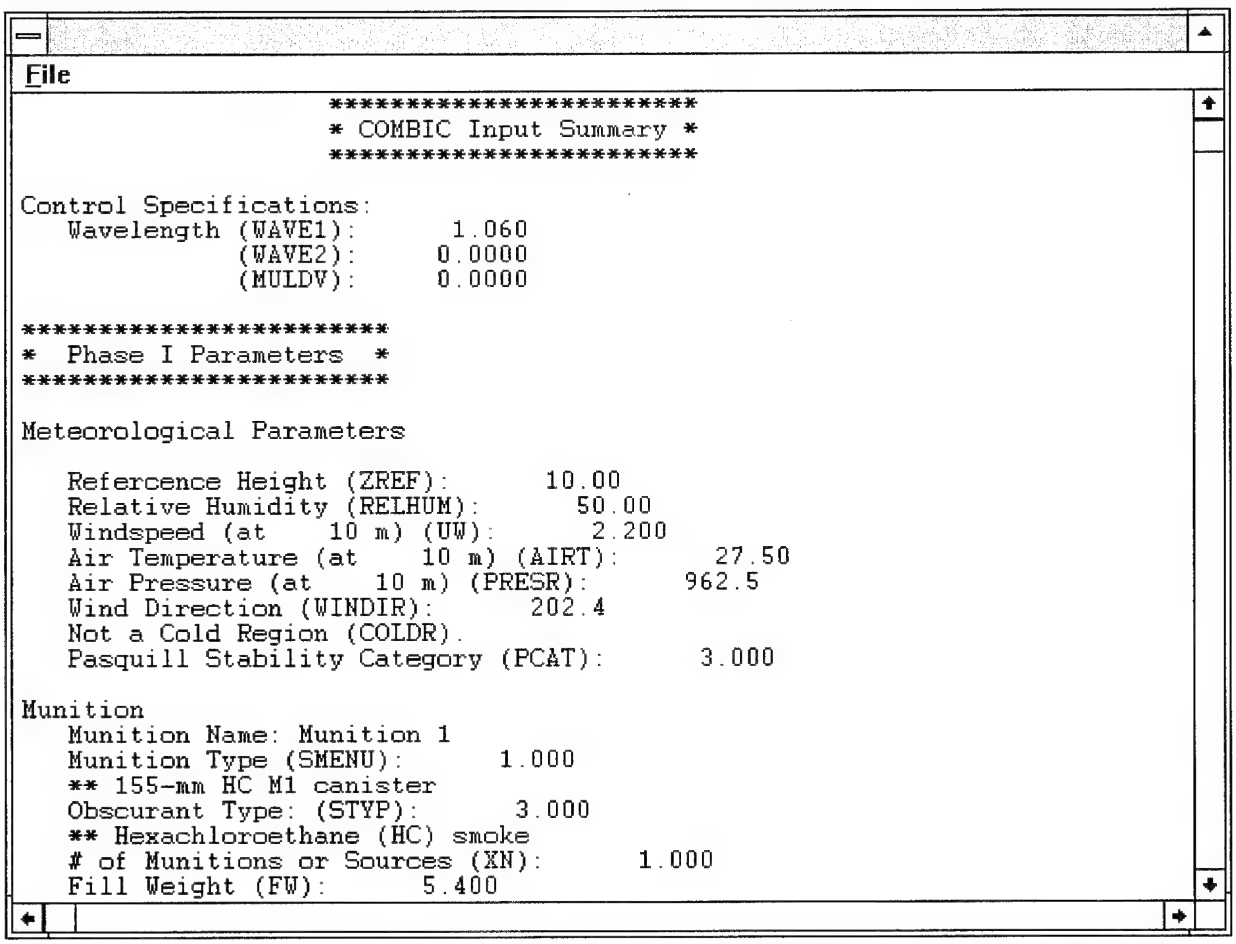


Figure B-36. View Text Window - COMBIC Input Summary

APPENDIX C

Cross Platform Window Examples

Appendix C
List of Figures

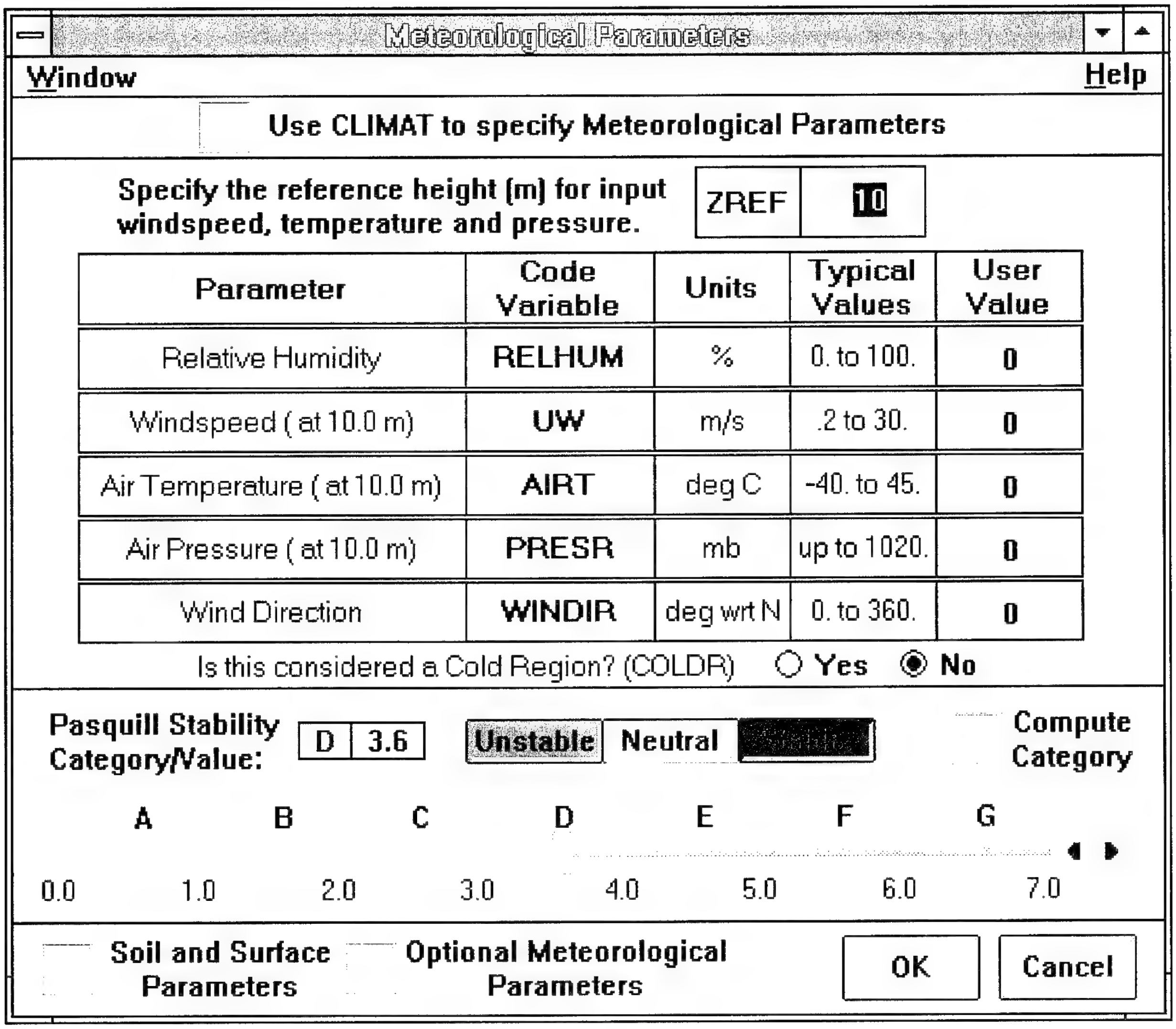


Figure C-1. COMBIC Meteorological Parameters Screen for Microsoft Windows

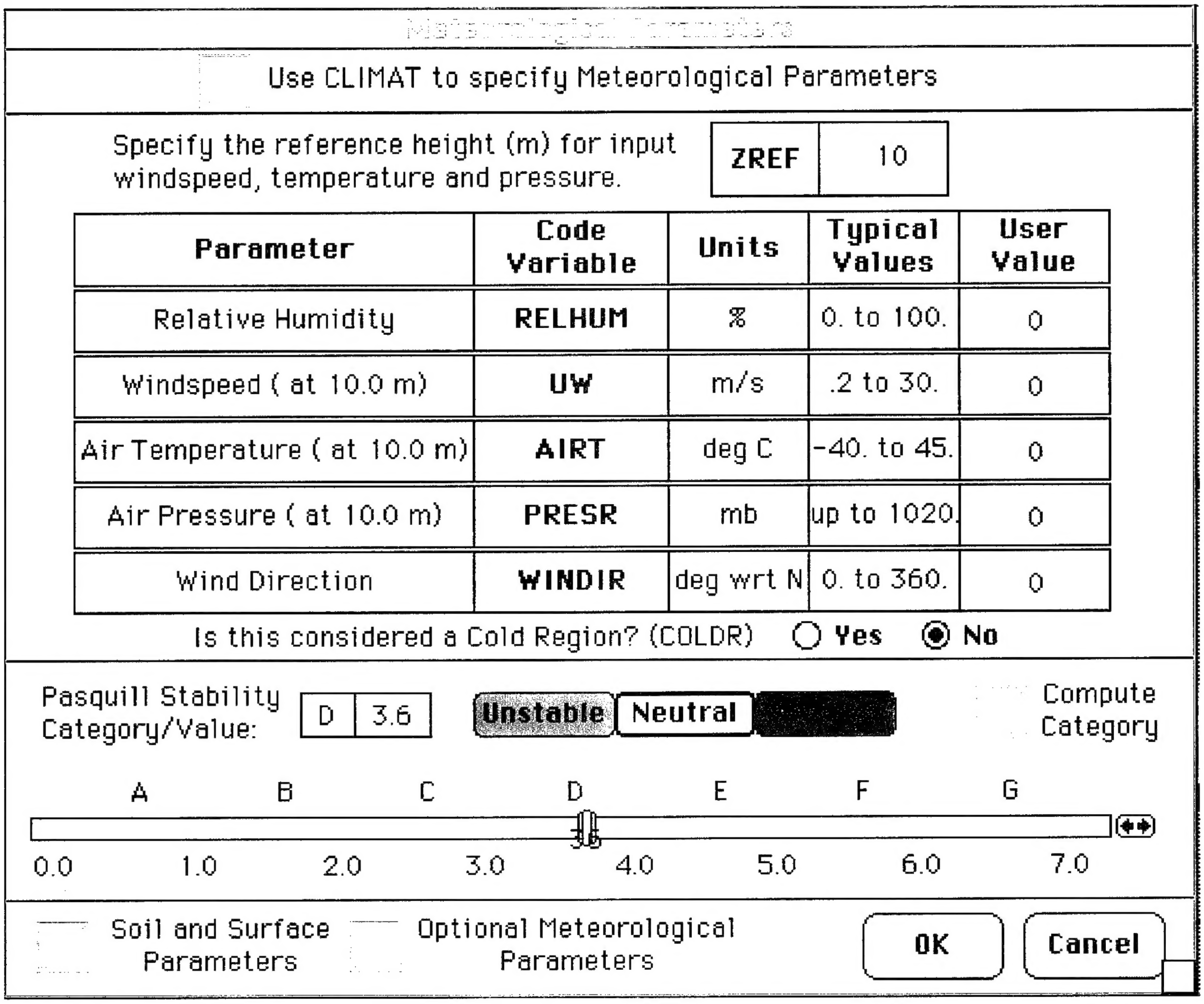


Figure C-2. COMBIC Meteorological Parameters Screen for Macintosh

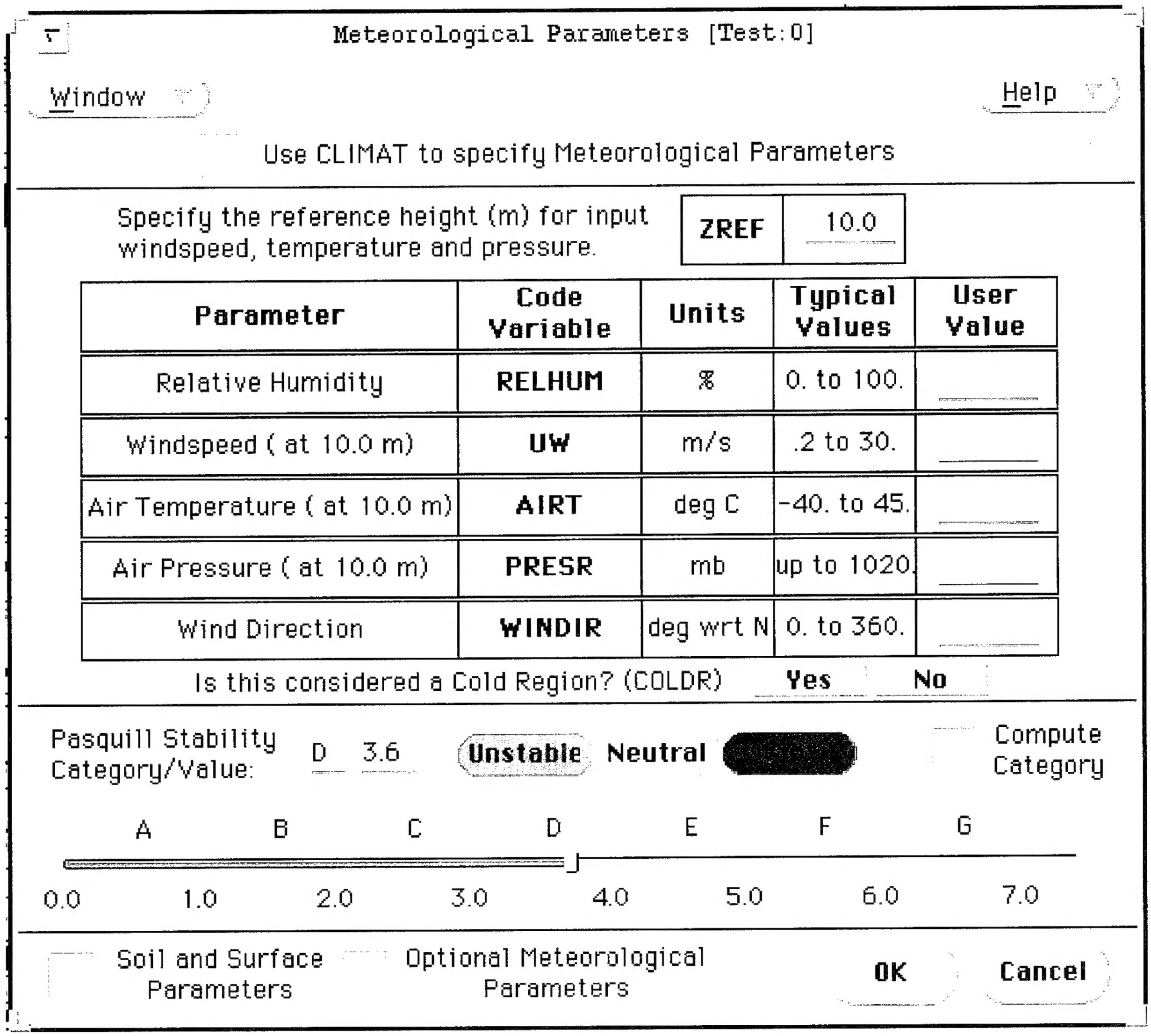


Figure C-3. COMBIC Meterological Parameters Screen for Sun Open Look

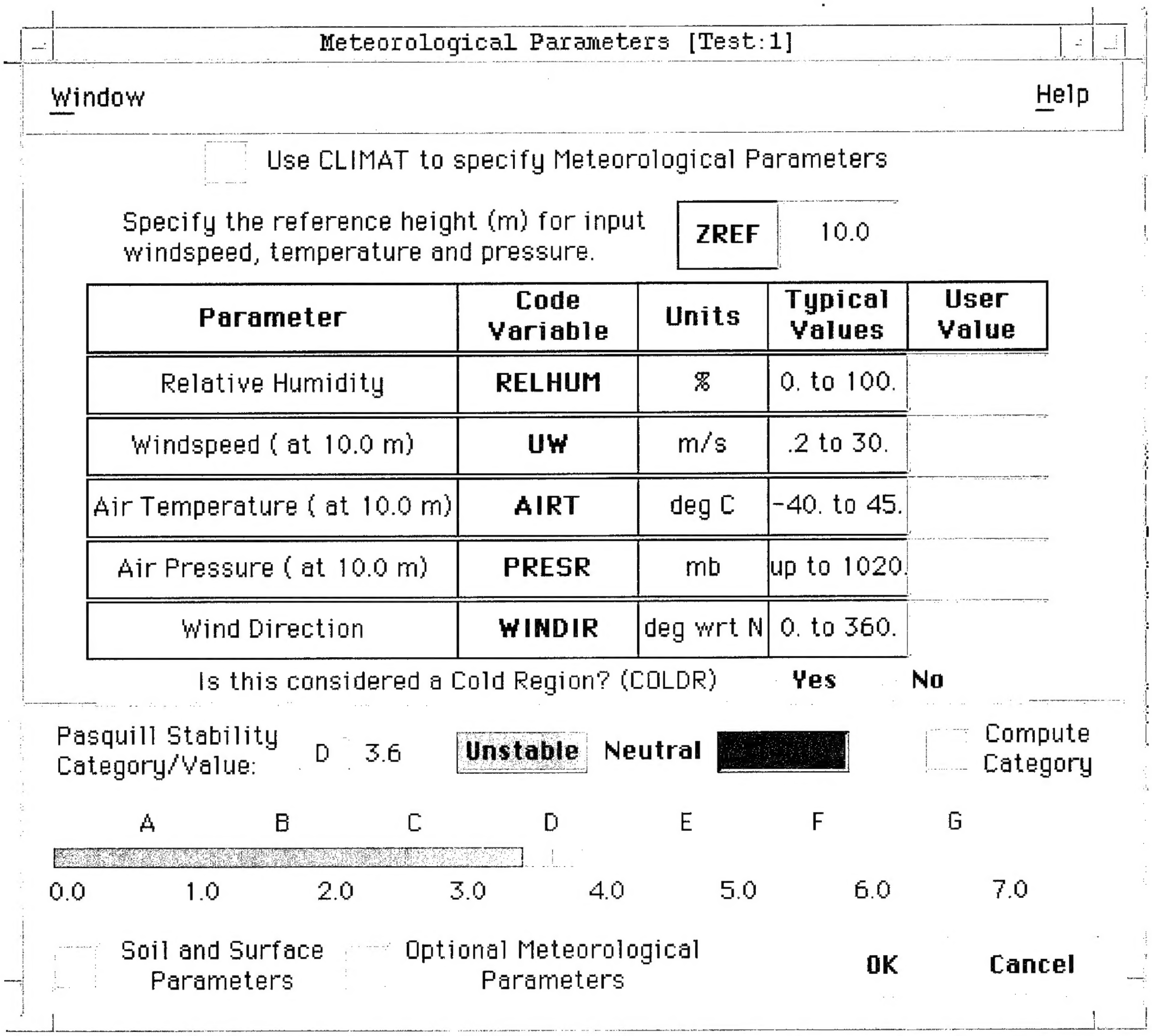


Figure C-4. COMBIC Meteorological Parameters Screen for Sun Motif

Major Platforms Supported

UNIX

- DG Aviion
- DEC RISC Ultrix
- DEC Alpha OSF/1
- DEC Alpha NT
- HP 9000 Series 700/800
- IBM RS6000
- Interactive UNIX
- NCR System 3000
- SCO
- Silicon Graphics
- Sun SunOS
- Sun Solaris for SPARC or Intel
- SONY NEWS (RISC)
- SONY NEWS (CISC)
- UnixWare

Microsoft Windows 3.X and Pen Windows

Microsoft Windows 95 (early 96 release)

Microsoft Windows NT

- Intel x86
- DEC Alpha

DOS - Character Mode

OS/2 - Presentation Manager

Macintosh

Power Macintosh

DEC Alpha Open VMS and VAX/VMS

IBM VM, MVS and CICS Mainframes